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CRITICAL READING ABILITY OF ELEMENTARY SCHOOL CHILDREN.

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DESCRIPTORS- *CRITICAL READING, READING SKILLS, *ELEMENTARY GRADES, OHIO STATE UNIVERSITY RESEARCH FOUNDATION,

THE FINAL REPORT OF A STUDY CONDUCTED TO DETERMINE (1) WHETHER CRITICAL READING SKILLS CAN BE TAUGHT TO ELEMENTARY SCHOOL CHILDREN WHILE MAINTAINING PROGRESS IN OTHER BASIC READING SKILLS, (2) WHETHER THERE IS A RELATIONSHIP BETWEEN CRITICAL READING ABILITY AND SUCH CHARACTERISTICS AS GENERAL READING ABILITY, INTELLIGENCE, AND PERSONALITY FACTORS, (3) WHAT KINDS OF TEACHER VERBAL BEHAVIOR ELICIT CRITICAL RESPONSES FROM CHILDREN, AND (4) WHAT ARE THE REACTIONS OF TEACHERS TO THE PROCESS OF TEACHING CRITICAL READING IS PRESENTED. THE SUBJECTS WERE 651 OHIO SCHOOL CHILDREN IN 24 INTACT CLASSROOMS, GRADES 1 THROUGH 6, WITH TWO CONTROL AND TWO EXPERIMENTAL CLASSES AT EACH GRADE LEVEL. EXPERIMENTAL CLASSES RECEIVED INSTRUCTION IN CRITICAL READING, WHILE CONTROLS RECEIVED INSTRUCTION IN CHILDREN'S LITERATURE FOR 1 ACADEMIC YEAR. A TEST-RETEST DESIGN WAS USED. AT EVERY GRADE LEVEL, THE MEAN SCORES OF THE EXPERIMENTAL CLASSES WERE SIGNIFICANTLY HIGHER THAN THOSE OF CONTROLS ON CRITICAL READING TESTS. NO SIGNIFICANT DIFFERENCES APPEARED BETWEEN GROUPS ON THE GENERAL READING TEST. OTHER FINDINGS ARE DISCUSSED. INSTRUMENTAL MATERIALS DEVELOPED FOR THE STUDY--A VERIFIED LIST OF CRITICAL READING SKILLS, LESSON PLANS, AN OBSERVATIONAL SCALE, AND CRITICAL READING TESTS--ARE APPENDED. (RH)

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FINAL REPORT

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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The Test Development Center of The Ohio State University with Dr. Daniel Stufflebeam as director and Mr. Dennis McFadden as assistant provided advice on the construction of the critical reading test. They also normed the test on a national sample and established the reliabilities for the test at the various grade levels.

Many other faculty members from The Ohio State University contributed their time and effort to make this project a success. Although listing all consultants would be too space consuming, the contribution of each of these individuals is appreciated.

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W.W.
C.S.H.
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TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION 1

Statement of Logical Framework 3
Purposes of the Study 6
Overview of the Study 7

CHAPTER TWO: REVIEW OF THE LITERATURE 9

Research on Critical Thinking 9
Critical Reading in Relation to Other Reading Skills 12
Factors Related to Critical Reading 15
Teaching Critical Reading 17

CHAPTER THREE: PROCEDURES 19

Developmental Phase 19

Refinement of the Definition 19
Pilot Observation Study 22
Development of the Observation Instrument 24
Development of Teaching Units 25
Development of the Critical Reading Tests 26

Experimental Phase 30

General Procedure 30
Sample 30
Design of the Study 31
Teaching Plan 32
Instrumentation 32
Observations 35

CHAPTER FOUR: PRESENTATION AND ANALYSIS OF DATA 36

Feasibility of Teaching Critical Reading 36

Analysis of Scores at Each Grade Level 37
Explanation of the Replication by Treatment Interactions . 46
Summary of the ANCOVA Data for Each Grade 48
Differences Across Grade Levels 50
Summary of the Comparison Across Grades 55

Factors Related to Critical Reading Ability 56

Correlations 56
Summary of the Correlations Across Grades 65
Effect of Instruction Upon the Correlations 69
ANCOVA on Intelligence and Sex Differences 70

Observations of Critical Reading Lessons 77

Summary of the Observation Data 95

Problems and Reactions of the Teachers 98

Discussion 102

CHAPTER FIVE: CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS . . . 108

Conclusions 108
Implications and Recommendations 111
Summary 114

REFERENCES 117

APPENDICES 121

A Pilot Observation Study 121
B Initial and Revised Definition of Critical Reading 130
C Sample Lesson Plans 136
D Sample Test Items 159
E Directions for Using Observation Scale 166
F Additional Tables of Results 174

Analysis at Each Grade Level 175
Analysis Across Grades 205
Intercorrelations 215
Analysis of Intelligence and Sex 221

CHAPTER I

THE STUDY OF CRITICAL READING

Introduction

Background of the Problem

Teachers in the United States have generally achieved a high level of success in teaching the mechanics of reading as evidenced by the fact that most graduates of American schools have mastered the basic reading skills. There is evidence, however, that a large percentage of the literate population are not discriminating readers who evaluate what they read. Chase (10) called this condition a higher level of illiteracy and described the "higher illiterate" as one who can absorb and repeat ideas found on the printed page but one who does not evaluate the ideas or relate them to the life around him. In a society where each person shares the responsibility for decisions in government, it is imperative that citizens have the ability to understand printed matter and to evaluate the ideas presented. Furthermore, freedom from censorship has a concomitant requirement of developing discrimination in the consumer. Therefore, it appears that some attention should be given to instruction in the skills of critical reading in today's schools if students are to be adequately prepared to serve as fully functioning citizens.

Goals of school curricula often include a statement of the desirability of critical reading skills; however, there is seldom a sequential plan for the development of these skills below grade seven. Further, empirical research in critical reading has been limited mainly to the high school levels. Psychological research has shown that once habits are established, it is difficult to change them. Thus, the didactic way in which reading is taught in the lower and intermediate grades may encourage naive acceptance of anything that appears in print. Postponement of instruction in critical reading skills could allow non-evaluative acceptance of all types of reading material to become so well established that subsequent learning and use of these skills would be difficult.

Even though critical reading has seldom been taught in the elementary school grades, there is little reason to justify its neglect.

Research in child development indicates that very young children of three and above are capable of critical reasoning and that five and six-year-old children can use all of their thinking abilities. Elementary school reading instruction frequently ignores higher level thinking skills of children and makes primary use of memory, recall, and interpretive abilities. Perhaps the reasons for the discrepancy between that which is theoretically possible and that which is practiced are (1) that elementary school teachers believe that children need a foundation in the basic reading skills before they can learn to read critically, (2) some think that children's growth in basic reading skills may be deterred as a result of time spent on instruction in critical reading, and (3) teachers do not have knowledge of the skills, techniques, or materials to teach critical reading. Therefore, the central purpose of this study was to ascertain whether critical reading skills could be taught to elementary school children while normal progression in other basic reading skills was maintained. Another purpose of the study was the identification of factors related to critical reading ability.

Definition of Critical Reading

Critical reading has been given various interpretations ranging from a narrow concept to a comprehensive one. For example, it has been restricted by some writers to the simple detection of propaganda techniques. Others have defined critical reading as encompassing nearly all levels of reading beyond the literal level. Smith (44) placed critical reading at the highest level in a hierarchy of reading comprehension skills. The hierarchy included (1) literal reading, understanding the denotation of words, ideas or sentences in context, (2) interpretive reading, obtaining deeper meanings not directly stated in the text, and (3) critical reading, evaluating the quality, the value, the accuracy, and the truthfulness of what is read. The present research encompasses both interpretive and critical reading as described by Smith. Robinson (38) developed the following definition of critical reading and made explicit some of the conditions that she believed necessary for its development:

> Critical reading "is judgment of the veracity, validity, or worth of what is read, based on sound criteria or standards developed through previous experiences." To develop critical readers, "it is essential that skills and abilities in reading for complete understanding be combined with:
>
> 1. an inquiring attitude;
> 2. a background to supply knowledge about the topic, field, or area to provide standards or criteria for evaluation;

3. the ability to suspend judgment until the writer's message is fully secured;
4. the ability to follow the organization or logic of the presentation, recognizing what is included and what is omitted;
5. awareness of the author's qualifications and intent; and
6. recognition of the publisher's commitments."

While this definition is more specific than others, it still lacks a detailed statement of the skills and abilities that are essential to the critical reading process.

Russell (41) maintained that critical reading was the application of critical thinking to the process of reading. He defined critical thinking as a three-factor ability, which includes an attitude factor of questioning and suspended judgment, a conative or functional factor which involves use of methods of logical inquiry and problem solving, and a judgment factor of evaluating in terms of some norm or standard or consensus.

In the initial stages of this study, the investigators used the definition of Robinson (38) and the construct described by Russell (41) to formulate the description of the desired behavior of a critical reader (see Appendix B for the initial and revised list of behaviors). As the study progressed the definition was further refined and expanded until a comprehensive set of the behaviors of a mature critical reader was obtained. This list of skills can be found in Chapter III on pages 20 to 22. Briefly, critical reading is defined in this study as an analytical, evaluative type of reading in which the reader analyzes and judges both the content of what is stated and the effectiveness of the manner in which the material is presented. Reading critically involves searching for the purposes underlying the author's message and making rational judgments about what is read based upon valid criteria. Critical reading skills can be applied to argumentative, informational or literary material.

Statement of Logical Framework

The Relationship of Critical Reading to the Total Reading Process

Critical reading is a sub-set of comprehension skills in the total framework of reading. It encompasses a set of skills which can be distinguished for the purposes of instruction and measurement but are not completely separable from other reading skills. For example, some basic achievements in word recognition skills are necessary before

the reader can move to even a minimal performance in literal or interpretive reading. Also, some minimal accomplishments are required in both word recognition skills and literal reading before the reader can be expected to read critically. Evaluative reading, then, is dependent upon the ability to recognize words and to get the idea the author intended. The mature reader is continually perceiving words, getting the literal meaning, interpreting, applying, and evaluating as he reads. Reading could be viewed, then, as a spiraling continuum of reading skills, i.e., the skills are interrelated, overlapping, and all are essential to the reading process.

Critical reading does not begin after the author's ideas have been grasped, but is an ongoing part of the process of securing meaning. Evaluation occurs at every stage of reading as the reader selects suitable information and rejects the unsuitable, interprets a descriptive phrase, recognizes the techniques of persuasion, or analyzes plot development.

The Relationship of Critical Reading to Critical Thinking

Similar to the idea that critical reading cannot be separated from the total reading process is the concept that it cannot be separated from critical thinking. Critical reading is the use of critical thinking in the evaluation of ideas presented in printed form. A comparison of a list of skills used in critical thinking set forth by Ennis (13) with the list of skills used by a critical reader shows great similarity. According to Ennis, some of the skills involved in the act of critical thinking are judging when a line of reasoning is logical, if a conclusion necessarily follows, and if a statement made by an alleged authority is acceptable. In the present study these skills are applied to printed material.

It is important to emphasize critical thinking in all areas of the elementary curriculum, but it particularly needs to be emphasized in the teaching of reading. Teachers too frequently have stressed the mechanics of reading to the neglect of the thinking aspect. Often the inherent rightness of the printed page is assumed, and children develop a non-questioning attitude toward their reading. Since the major portion of the school day is devoted to reading instruction, many opportunities are provided for teaching critical reading.

The research efforts have been mainly in the area of critical thinking. However, that ability in critical thinking automatically transfers to an evaluation of the printed page without training has not been established. Hence, it appears that research in critical reading is warranted.

The Nature of the Critical Reader

The present study was based upon the assumption that children of all ages can learn to read critically. Research in child development has substantiated the belief that children can use higher level reasoning processes by age three. Children of this age have shown that they can evaluate ideas that are within the realm of their own experience. Almy (1), Wann, et al (53) have reported that pre-school children have access to all types of thinking behavior and are limited only by their background of experiences. Critical reading is the use of critical thinking in the act of reading. If young children can think critically one could infer that they can be taught to read critically.

Findings from other research studies have indicated that certain characteristics such as intelligence, personality, attitudes, sex, and general reading ability may be related to the ability to read critically. Glaser (17) found that intelligence, reading ability, and school marks are positively related to scores made on critical thinking tests. It could be hypothesized that these same factors will be related to scores on a test of critical reading ability. Piekarz (36) supported the idea that attitudes affected reading at the perceptual level by helping to determine the printed words that were actually seen, at the understanding level by coloring, twisting, and distorting ideas, and at the retention level by specifying what was remembered and what forgotten. Similarly, Watson (54) described selective perception and retention as personality factors that inhibit change. Examining another factor, Waetjen (52) described sex differences in learning which may affect the level of skill development achieved by boys or girls. The relationship of many of these factors to critical reading ability is explored in this study.

The Nature of Teaching Critical Reading

Studies by Rogers (39), and Gray (18) have shown that the ability to analyze and evaluate ideas does not develop naturally as a concomitant of chronological age. Rather, critical reading behavior is learned, and proper and systematic instruction in the skills that contribute to it are necessary.

Teaching critical reading involves a number of identifiable acts on the part of the teacher. The teacher needs to recognize the goals of critical reading and to be familiar with the list of specific skills which contribute to critical reading behavior.

To obtain more ideas about the nature of teaching critical reading, a pilot observation study was conducted prior to the developmental and experimental phases of this research study. (For procedures, including observation instrument, and findings, see Appendix A.) Observations

indicated the following components of a critical reading lesson: (1) establishing a background of information, (2) refining, analyzing and applying the information, and (3) evaluating and summarizing in an effort to draw valid conclusions or to make appropriate generalizations. The nature of the teachers' questions determined to some extent the type of response that was elicited from the pupils. When teachers discussed the material read with the children and asked questions requiring evaluation, critical responses occurred more frequently than if the teacher asked factual questions.

Purposes of the Study

The central purpose of this study was to determine if elementary school children could be taught to read critically. More specifically, the purposes were:

1. To determine whether or not critical reading skills can be taught to elementary school children while normal progression in other basic reading skills is maintained.

2. To determine whether there is a relationship between ability to read critically and other characteristics such as general reading ability, intelligence, and personality factors.

3. To determine what kinds of teacher verbal behavior elicit critical responses from children.

4. To obtain the reactions of teachers to the process of teaching critical reading.

In order to achieve the major goals, several instrumental goals were recognized. These goals were:

1. To refine and verify a list of critical reading skills.

2. To develop materials for teaching critical reading skills.

3. To construct a valid and reliable instrument for measuring critical reading ability.

4. To design an observation procedure for recording and classifying teacher and student verbal behavior.

Questions to be Answered in the Study

1. Can critical reading skills be taught to elementary school children while normal progression in other basic reading skills is maintained?

   a) Will children who receive special instruction in critical reading gain significantly more than those who did not receive this special instruction?
   b) Will children who receive special instruction in critical reading make comparable gains in general reading to children who did not receive this instruction?
   c) Is there a significant difference in the ability of children of different grade levels to read critically?

2. Are there relationships between ability to read critically, and certain other factors?

   a) Is there a relationship between critical reading ability and general reading ability, intelligence, and personality?
   b) Do students at all intelligence levels gain in critical reading ability?
   c) Do boys and girls gain equally in critical reading ability?

3. What types of teacher verbal behavior elicit critical responses from children?

   a) Are there significant differences in the type of questions that control and experimental teachers ask?
   b) Are there significant differences in the types of questions asked at different grade levels?
   c) Is there a change in the types of questions asked during different periods in the school year?
   d) Are there significantly more critical responses elicited in the experimental than in the control group?
   e) What types of questions elicited the most critical responses from pupils?
   f) Is there a change in the level of pupil responses during different periods in the school year?

4. What were the teachers' reactions to their attempts to teach children to read critically? What problems did they encounter?

Overview of the Study

The purpose of developing critical reading abilities in elementary school children is to contribute to a citizenry who can intelligently evaluate printed materials. In this study critical reading is identified

as a part of reading comprehension and is defined as an analytical, evaluative type of reading in which the reader analyzes and judges both the content of what is stated and the effectiveness of the way it is written. Reading critically involves searching for the purpose underlying the message and making rational judgments about what is read based upon valid criteria.

The research was conducted in two major phases: developmental and experimental. The developmental phase included (1) the refinement and verification of a list of critical reading skills, (2) a pilot observation study for identification of appropriate techniques and materials for teaching critical reading, (3) preparation of experimental materials, and (4) the construction of a measuring instrument.

In the experimental phase (1) training sessions were provided for all teachers in the study, (2) pretests of critical reading and general reading were administered to the subjects in the fall, (3) experimental lessons were taught during an entire academic year, (4) systematic observations were made, and (5) posttests were administered in the spring.

Literature related to the major aspects of this study is reviewed in Chapter II and the procedures used are described in Chapter III. The final chapters are devoted to the findings, conclusions, and implications of the study.

14

CHAPTER II

REVIEW OF THE LITERATURE

The term "critical reading" appears frequently in educational literature but the meaning attached to it varies widely. Much of this variability in meaning is the result of insufficient research evidence regarding both the abilities inherent in the skill of reading critically and the factors related to such competency. Research in critical reading that is focused on elementary school children is especially meager. In this chapter reports of research on both critical reading and critical thinking are included. Pertinent theoretical articles are cited when they help to clarify purposes, structure, or findings in the area of critical reading.

Research on Critical Thinking Relevant to Critical Reading

Critical reading is the application of critical thinking skills to the reading act. The research on critical thinking is more extensive and generally more experimentally sound than the research on critical reading.

As late as 1962, Ennis (13) noted a deficiency in the comprehensiveness of the definition of critical thinking. He states that, "There has been a lack of careful attention to the concept 'critical thinking' and furthermore, no comprehensive, thorough, up-to-date treatment of this concept is available." The researcher provides his definition of three dimensions of critical thinking: (1) Logical -- judging the alleged relationships between meaning of words and statements, (2) Criterial -- judging ideas presented, and (3) Pragmatic -- judging whether the statement is good enough for the purpose held. This definition includes many of the concepts included in critical reading.

Based upon a research review, Durrell and Chambers (12) noted the following essentials for research in thinking: a definition of terms, construction of measures of thinking abilities, and the design and evaluation of materials and methods of teaching thinking. Many of the experimental studies reviewed below reveal an attempt to (1) define specific thinking skills, (2) develop materials for teaching them, and (3) measure achievement with appropriate instruments. Al-

though the scope and precision of the studies vary, the findings generally indicate that critical thinking skills can be improved through direct instruction.

One of the most widely-quoted studies using direct instruction was implemented by Glaser (17). The experimenter developed materials and techniques to stimulate growth in ability to think critically and tested them in four twelfth-grade English classes for ten weeks, using a pretest-posttest control group research design. The average gain in critical thinking ability on a battery of tests developed by the author was significantly greater for the experimental groups than for the control groups.

Anderson et al (2) conducted an experiment to determine if students could learn to abstract, organize information, and draw conclusions -- processes which they identified as critical thinking skills. Twelve to fifteen matched pairs of seventh-grade experimental classes and the same number of tenth-grade experimental classes were tested on their ability to solve critical thinking problems through two approaches: "doing and telling." The problems based on the "doing" method allowed the pupils freedom to study and analyze the content on their own while the material in the "telling" problems was more directive. The differences were negligible between the two experimental groups. The experimental groups were also compared with the control groups which received no instruction. The control groups did as well on abstracting and organizing information as did the experimental groups, but were lower on drawing conclusions. Hence, the authors conclude that the critical thinking problems made their most important contribution in developing skills associated with the drawing of conclusions.

Seventh graders were the subjects of another research program (25) intended to improve the ability of the students "to think logically and therefore critically." The intelligence, mental age, reasoning ability, language proficiency and initial reading ability of 200 children were measured and, from the data secured, two paired and equated groups of thirty-three children were formed. At the beginning of the study the two groups were equal in reasoning ability, but there was a significant difference favoring the experimental group at the final testing which showed that logic can be taught to upper-grade children. Hyram appears to equate logic with critical thinking. Although the investigators of this study include logic as an important part of the skills of critical thinking and critical reading, they also include other skills as well.

In a study assessing elementary school children's ability to master mathematical logic, Suppes and Binford (47) found that the achievement level of the upper quartile of elementary school students was 85 to 90 per cent of that achieved by comparable university students.

Brownell (8) studied the effects of an instructional reading program on the gain scores of two ninth-grade classes. The measuring instrument was the Watson-Glaser Critical Thinking Appraisal. The data collected provisionally support the hypothesis that a twenty-eight week program designed to improve reading skills in social studies will result in significant total score gains on the critical thinking test. There is no conclusive evidence that the significant gains were caused by the training in reading alone. Subjects at the upper and lower levels of the intelligence distribution constituted the majority of subjects who made more than a median improvement on the Watson-Glaser Test. Brownell believes that the Watson-Glaser Critical Thinking Appraisal may be a measure of reading ability and raises the question of whether this test can be used to measure critical thinking apart from reading ability.

Most of the research studies mentioned above used junior and senior high school students as subjects while other researchers have focused their efforts on children in the elementary school. For example, Grener and Raths (20) used a third-grade class for a limited study of critical thinking. The test employed was one developed by Raths (37) and a group of teachers from Euclid, Ohio. The teachers had two purposes for constructing such an instrument: first, to analyze the causes of confusion in a child's thinking, and second, to make teachers more aware of the elements which cause the confusion. The group was tested in September and again in January. The experiment showed that children can perform higher thinking processes to some degree.

Arnold (3) used a problem discussion technique to teach critical thinking to fifth and sixth-grade students. He wanted to determine if students could make intelligent judgments about the relevancy, dependability, bias in source, and adequacy of data concerning a particular problem, question, or conclusion. A control group was given no instruction. Arnold's hypothesis that critical thinking can be taught was supported.

Recently Taba (48) directed a study concerned with the thinking of elementary school children. Although the researcher stated that critical thinking *per se* was not being measured, the experimental treatment included the teaching of the skills of interpreting, inferring, and generalizing. Considerable growth in the transformation of concrete thought into formal thought from the second to the sixth grade was found. The data seem to imply that training in thinking accelerates the pace of thought development. In other words, children can learn to make inferences, to generalize, and to make logical assumptions at an early age if they receive systematic instruction in thinking skills.

As a result of his study of the cognitive development of children, Piaget (35) identified age levels at which specific thought processes appeared. Formal thought, according to his schema, manifests itself

around age twelve. The developmental sequence theorized by the Swiss psychologist is affirmed in Taba's study, but the age placement of the thought processes is not. Taba's study adds to the growing body of evidence to support the claim that the occurrence of formal thought can be accelerated by instruction.

There are a number of similarities between Taba's study and the research in critical reading reported here. In each there is recognition of the importance of the following elements: (1) systematic instruction, (2) the nature of teachers' questions, and (3) the teachers' confidence that children are capable of a higher level of thought than they ordinarily exhibit.

Taba found the beginnings of formal thought processes in grade two; other researchers have evidence that children can handle aspects of critical thinking even before that time. Smith (43) examined 20,000 sentences spoken by children of ages two to six and found 325 statements which showed evidence of evaluation. Wann (53) shows that children are capable of a wide range of thought between the ages of three and five, and that this ability can be influenced positively by knowledgeable teachers. A repeated finding from these studies is that instruction accelerates the thinking process.

The scarcity of valid and reliable instruments for measuring critical thinking has resulted in the sporadic growth of knowledge about this ability in children. This lack is especially noticeable at the elementary school level. A review of the literature on critical thinking reveals other general inadequacies of research design and treatment including the need for (1) developing an adequate definition as a basis for the research, and (2) controlling the experiment sufficiently so that the findings can be generalized beyond the sample.

Critical Reading in Relation to Other Reading Skills

Measurement of reading ability has developed from a time when one score represented a child's total reading ability to the current status where a detailed explication of specific types of reading skills is expected. One of the first educators to define specific skills in critical reading was DeBoer (11). He said critical reading was an active rather than a passive approach to the printed page, the ability to distinguish relevant from irrelevant data, and the existence of skepticism so that the reader will evaluate the reliability of evidence and the soundness of conclusions. More recent and comprehensive definitions have been contributed by Robinson, Russell, and Smith (see pages 2 and 3 of this report). An early differentiation of a specific critical reading skill was attempted in Gans' study. In her study of fourth, fifth, and sixth graders, Gans (16) identified the ability to select or reject relevant and irrelevant materials as a critical reading skill.

In her test, subjects were required to select from relevant sources in order to solve a problem and to explore a topic. The students were provided with the following five types of material: (1) completely descriptive factual material as found in textbooks, (2) descriptive material not obviously related, (3) encyclopedic content not really relevant to the topic, (4) fanciful and imaginative material from literature, and (5) material completely irrelevant but written like the other materials. Students were unable to see relevancy in remotely relevant material; they selected encyclopedic material even though it was not relevant; they accepted fanciful material as acceptable sources; and they rejected relevant material if it tended to disprove what they were trying to prove. Gans concluded that children were not being taught to be discriminative about the authenticity of content or the relevancy of materials. Although she recognized that critical reference reading was made up of several abilities, she believed that general reading ability was the most potent factor.

Sochor (46) still contended in 1959, that for all practical purposes, literal and critical reading could not be differentiated except on the basis of the reader's purpose. Other researchers have attempted to separate them on other bases. In one of these studies, McCullough (32) analyzed reading comprehension tests to determine if they were measuring essentially different things. She identified the following four types of questions found in measures of reading comprehension: (1) main idea, (2) facts or details, (3) sequence or organization, and (4) creative reading which included drawing inferences and conclusions, passing judgments, and seeing relationships. When McCullough analyzed the scores of three different tests, she found a positive relationship among the four types of comprehension questions but the degree of the relationship did not justify the idea of testing children by one type in order to discover their ability in other types. Individual predictions of scores on one type of comprehension from scores on another type were impossible. The area that McCullough labeled creative reading encompasses specific skills which are considered in this report to be a part of critical reading. Her analysis supports the premise that critical reading is a distinct ability and should be measured apart from other reading skills if competence in critical reading is to be accurately assessed.

Maney (31) and Sochor (45) also questioned the traditional use of a single reading test to measure reading ability in all situations as well as the assumption that critical reading skills develop as a concomitant of intelligence, maturation and normal school progression. Maney examined the relationship between general reading ability and critical reading ability of science material. Using a sample of 513 fifth-grade pupils, she found the correlation between general reading ability and critical reading of science to be only .11 when intelligence was partialled out. Sochor used the same sample as Maney to investigate the relationship between general reading ability and the ability to read critically in social studies. Again, the relationship between

general reading ability and critical reading ability of social studies material was low; in this case it was .23 with intelligence partialled out. Sochor concluded that critical reading comprehension in social studies appeared to be virtually independent of "general" reading ability when the effects of intelligence were taken into account.

Further, Shores and Saupe (42) attempted to find out if reading were a general ability or if reading for problem solving in science required distinct skills. The authors state that the study skills required by problems in science involved both reading and thinking critically. They found a correlation of .63 between science reading and general reading ability which suggests that the two tests were measuring the same factor to some extent. In this study intelligence was not partialled out in the statistical analysis.

Although many researchers have shown that critical reading abilities cannot be inferred from a measure of literal reading, few are willing to separate the two entirely. In order to read critically, one must first be able to comprehend the literal message intended by the author. Artley (4) states that although literal comprehension is ordinarily conceived as the process of identifying and recalling facts, it need not be a non-critical process. Betts (6) supports the idea that literal and critical reading are not an "either-or" process. He says:

> Assimilative and critical reading are not dichotomous. Instead, depth of comprehension is a matter of degree. Reading of the predominantly assimilative type emphasizes the identification and recall of facts. Reading of the predominantly critical type emphasizes the higher thought processes having to do with the selection-rejection of ideas, the relationships between ideas, and the organization of information.

Gray (18) states that literal reading has a critical nature because getting the literal meaning necessitates the accurate perception of words, the fusion of separate meanings into ideas, grasping the organization and relationship of ideas, and a reasonable fluency of perception. He adds, "obviously an inquiring attitude and good thinking are required at every step in the apprehension of the literal meaning of a passage."

In summary, there is evidence that skills labeled as critical reading skills can be distinguished from those required for literal comprehension. Further, it is generally believed that literal reading skills are basic to critical reading performance.

Factors Related to Critical Reading Ability

There has been some experimentation at the elementary school level on factors affecting children's ability to read critically. Relevant information on these factors can also be gleaned from research at the college and high school levels. Factors which educators believe to have a potential relationship to critical reading are attitudes, intelligence, general reading ability, background of experience, personality, perception, and creative thinking abilities. The bulk of the research activity has been with the relationship between critical reading and factors of attitudes, intelligence, and general reading.

Attitudes

Attitudinal factors have been shown to influence the meaning obtained from reading as well as the facts remembered. Thayer (49) used 112 college sophomores as the subjects of a study which investigated the relationship between readers' ethical and moral values and their conceptualization of a fictitious character and his environment. The findings indicate that the readers ascribed characteristics they valued to the character in the story. In other words, the values of the subjects colored their conceptualization and thus provided a preconceived frame of reference for their reading.

Five hundred and twelve eleventh-grade students were the subjects of an experiment by McKillop (33) who studied the relationship between the reader's attitude and certain types of reading responses. Measurements were taken of general reading ability and attitudes, with attitudes measured by tests constructed by the researchers. In the experiment the students read passages concerning Negro-White equality, living conditions under communism, and Arab objections to the establishment of Israel. The passages corresponded to the topics on the attitude tests. Students answered two types of questions: some of the highly structured type, and others calling for the making of inferences, judgments, and evaluation. The results of the study showed that the relationship between attitude toward a topic and the response to reading passages depended in part on the kind of questions asked. If there were a "right" answer to the question, the subjects provided this answer and did not reveal their own feelings. Attitude became a more important factor if there were no correct answer given in the passage and the subjects were provided an opportunity for making a judgment.

Groff (21) found a positive relationship between expressed attitudes toward different types of reading material and scores on a critical reading test when he studied 305 fifth and sixth-grade children. The critical reading test covered three basic areas: sensing organization, making inferences, and drawing conclusions. Relationships between the critical reading scores and (1) attitudes expressed toward reading as

a school activity and (2) attitudes expressed toward school, classmates, and teachers were also explored. Correlations between general reading ability and attitudes toward the four content types of reading material were negligible, but the correlations between attitudes toward content and critical reading test scores were significant. Another important finding of Groff's study was that significant sex differences were observed in the interest shown in specific passages.

As a result of extensive case studies of two students, Piekarz (36) stated that attitudes affect reading at the perceptual level by helping to determine the printed words that are actually seen, at the understanding level by coloring, twisting, and distorting ideas, and at the retention level by specifying what will be remembered and what will be forgotten. On the basis of the findings of the preceding studies, it appears that attitudinal factors may influence the reader's ability to think critically about what he reads.

Intelligence and General Reading Ability

In addition to attitudinal factors, researchers have investigated the factors of intelligence and general reading ability as they are related to the ability to read and think critically. In Glaser's (17) experiment on critical thinking, he concluded that general intelligence, as measured by the Otis Quick-Scoring Mental Ability Test, is different from the abilities measured by the Watson-Glaser Critical Thinking Appraisal. However, the tests overlap and some common abilities are assessed. Glaser reported that the two factors most clearly related to scores on the critical thinking test were found to be intelligence and reading ability. The correlation between these two factors themselves was .71. Intelligence correlated with the composite test of critical thinking at .48 and the reading scores correlated with critical thinking at .36. Although there was a tendency for the more intelligent groups to profit most from the training in critical thinking, there were individuals with intelligence scores of less than 100 found among those who profited most from the training in critical thinking.

Maney (31), in a study of critical reading in science, found a correlation of .83 (significant at $p < .01$) between scores of verbal intelligence and general reading comprehension; .75 between verbal intelligence scores and literal reading of science; and .67 between verbal intelligence and the critical reading of science. The influence of intelligence is shown clearly in the following data: general reading comprehension and literal reading of science correlate at .75, and general reading and critical reading at .60. With intelligence held constant, the first correlation becomes .35; the one involving critical reading scores falls to .11. The findings from Sochor's study (45) in social studies agree with Maney's findings.

Thus, it appears from the research studies reported here that

attitudes, intelligence and general reading do affect ability to read critically.

Teaching Critical Reading

Only a few studies have been reported in which an attempt was made to teach critical reading *per se* to elementary or high school students. Among these are the ones by Kay (26) and Nardelli (34). Using a pretest-posttest design, Kay measured gains of 385 high school students who were instructed on four dimensions of critical reading. She found that between 14 and 22 per cent of the students did gain in their ability to form their own conclusions, to discern the author's purpose and to make comparisons of conflicting or correlating ideas by one or several authors. Furthermore, less than 6 per cent of the students were able to improve in their ability to discover inaccuracies, inconsistencies and omissions of essential information. Since a control group was lacking it is impossible to tell if the results were due to the treatment or some other factor.

Five experimental and three control groups consisting of sixth-grade classes were matched on reading ability, chronological age, I.Q., and initial creative reading ability in the research of Nardelli. Tests to measure ability to (1) interpret authors' suggestions, (2) interpret feelings, and (3) recognize propaganda devices were administered. Lesson units to improve the abilities thus tested were designed by the researcher and taught by him to the experimental groups. A statistically significant mean gain for the experimental group was obtained, with the major gains in the area of recognizing propaganda devices.

These two studies are representative of the research on the teaching of critical reading. Although the research indicates that aspects of critical reading can be taught in the upper elementary and high school grades, the studies display certain inadequacies such as a lack of control in the research design, or inadequate statistical treatment of the data.

Closely related to research in teaching critical reading is a more comprehensive study directed toward teaching another skill, critical listening. Lundsteen (29) compared a group of fifth and sixth-graders (N = 287) who had nine weeks of instruction in critical listening with a group who followed the usual English curriculum. The lessons focused on (1) detecting the speaker's purpose, (2) analyzing and judging propaganda, and (3) analyzing and judging arguments. Critical listening was defined as the process of examining ideas, comparing them with some consensual data, and acting or concluding upon the judgment made. In the two-group experiment a significant difference (.01 level) was found in favor of the experimental group exposed to lessons in critical listening.

The study undertaken by the authors of this report builds on the findings of the studies reviewed in critical reading and critical thinking. However, it differs from most in that the materials were developed after extensive observations; experimental teaching extends down to grade one; the lessons incorporate varied and unique aspects of critical reading; and the experimental teaching was done for an entire academic year.

CHAPTER III

PROCEDURES OF THE STUDY

Developmental Phase

Several necessary developmental activities were undertaken prior to the experimental phase in the Critical Reading Project. These activities included refinement and verification of the definition of critical reading, observations of classrooms to pilot test techniques and materials, development of an observation instrument, development of teaching units for the experimental treatment, and development of a test of critical reading.

Refinement and Verification of the Definition of Critical Reading

Preliminary to the development of materials for the experimental treatment and test items for the measuring instruments, it was necessary to develop an extensive operational definition of critical reading. In the initial planning stage, the investigators identified specific skills that they believed a mature critical reader would exhibit. This list of critical reading skills (see Appendix B) was stated in behavioral terms and was based on a definition proposed by Helen Robinson (38) and a three-factor construct described by David Russell (41). During the initial phase of the project, this list of skills was sent for validation to fourteen reading experts across the country.* The panel of experts was asked to critique the list, to rate the importance of each skill, and to suggest any other skills they believed contributed to critical reading ability. Following their recommendations the list of critical reading skills was revised. During the pilot observation study (described in Appendix A) this list was checked for completeness in elementary school classrooms. When critical reading behaviors were observed other than those already included in the definition, they were added to the list.

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*The panel of reading experts to whom the tentative definition of critical reading was sent included: David Russell, Nila Banton Smith, Russell Stauffer, Donald Cleland, Helen Robinson, Constance McCullough, Sterl Artley, Robert Ennis, William Sheldon, Albert Harris, John DeBoer, William Eller, Ruth Strickland, and Roy Kress.

The following skills for the critical reading of all types of materials including informational, persuasive, and literary were identified:

I. Analysis and Evaluation of Informational and Persuasive Material

A. Semantics in Writing

1. Distinguishing between vague and precise words.
2. Recognizing the difference between connotative and denotative meanings of words.
3. Recognizing the persuasive use of words through such devices as: name calling, glittering generalities, and plain folks.
4. Evaluating the effectiveness of the use of words according to the author's purpose.

B. Logic in Writing

1. Recognizing and evaluating the validity of writing.

   a) Examining the validity of an argument, i.e., judging whether conclusions necessarily follow from premises.
   b) Classifying into groups and sub-groups.
   c) Determining appropriate use of all, some, and none statements.
   d) Discovering unstated premises and conclusions.

2. Recognizing and evaluating the reliability of printed materials.

   a) Discovering ways to test the reliability of information.
   b) Determining soundness of premises and conclusions.
   c) Detecting material fallacies, e.g., hasty generalizations, unrepresentative generalizations, faulty causal generalizations, post hoc reasoning, false analogies, false dilemmas, fallacies of composition and division, and all or nothing statements.
   d) Recognizing illogical reasoning in persuasive writing, e.g., testimonial, identification and transfer, band wagon, card stacking.
   e) Recognizing and evaluating different forms of informational and persuasive writing.
   f) Distinguishing between objective and subjective evidence.
   g) Judging the reliability of information.

C. Authenticity of Writing

1. Recognizing adequacy of information or the necessity of suspending judgment.
2. Comparing relevant information from multiple sources to recognize agreement or contradiction.
3. Recognizing authoritative sources and evaluating them according to established criteria.
4. Evaluating the qualifications of the author.
5. Recognizing the publisher and sponsor's commitments.

II. Analysis and Evaluation of Literary Material

A. Literary Forms

1. Recognizing characteristics of various genre of fiction, such as: fantasy, realistic fiction, historical fiction, and biography.
2. Distinguishing among variants of a particular form of fiction. For example, distinguishing between various forms of fantasy: make-believe, fairy tale, folk tale, modern fantasy, fable, myth, science fiction, allegory.
3. Developing criteria for evaluating each type of fiction.
4. Recognizing the characteristic forms of poetry, e.g., narrative, lyric, haiku.
5. Developing criteria for evaluating poetry.

B. Components of Literature

1. Identifying and evaluating characterization.

   a) Distinguishing between character delineation and character development.
   b) Recognizing ways the author reveals character.
   c) Developing criteria for assessing characterization.
   d) Comparing and evaluating methods of character development in two books.

2. Identifying and evaluating plot structure.

   a) Recognizing the structure of the plot: accumulative, episodic, parallel.
   b) Tracing the development of plot structure: the sequence, the climax, denouement.
   c) Recognizing ways of attaining the climax: suspense, surprise, size and color of pictures.
   d) Recognizing and evaluating effectiveness of special techniques of plot development: foreshadowing and flashback.

3. Identifying and evaluating setting.

   a) Recognizing the elements of setting: place, time.
   b) Understanding the relationship of setting to action and character development.

4. Identifying and evaluating theme.

   a) Distinguishing between theme and plot in a story.
   b) Identifying the story theme and comparing themes in several books.
   c) Evaluating effectiveness of theme presentation.

C. Literary Devices

1. Identifying and evaluating author's use of language.

   a) Interpreting and evaluating figurative language: metaphor, simile, personification.
   b) Evaluating the use of dialogue and authentic speech.
   c) Evaluating the author's style of writing.
   d) Interpreting symbolism and judging its effectiveness.

2. Identifying and evaluating mood of writing.

   a) Recognizing the mood of selected poems and stories.
   b) Recognizing different ways the author achieves humor: surprise, slap-stick, exaggerations, anachronism.
   c) Recognizing the effective use of satire or irony.

3. Identifying and evaluating point of view.

   a) Recognizing the point of view from which the story is told.
   b) Considering how the story would be different if told from another point of view.
   c) Comparing books written from different points of view.

Pilot Observation Study

The major purposes of the pilot observation study were to obtain

ideas for materials and techniques for teaching critical reading and to check the completeness of the definition of critical reading behaviors. In order to carry out these purposes, thirty teachers were observed who had been identified as teaching critical reading.

An observation instrument was developed with three categories for teacher verbal behavior: gathering information, refining-clarifying, and applying-evaluating. When the teacher asked a question requesting a specific answer from the pupil which was available in the reading material or class discussions this behavior was labeled gathering information. If a question required the pupil to use or evaluate information from the reading material it was labeled applying-evaluating. Such questions included those asking pupils to hypothesize, infer and evaluate. Questions which were categorized as refining-clarifying asked for refinement of previously-discussed ideas or information which had been misinterpreted by the students.

Pupils' responses were classified as critical or non-critical, depending upon the type of thinking exhibited. A response was defined as non-critical if it could be drawn directly from the material being used. These included factual answers, literal comprehension, verbatim reporting and repeating responses previously made by the teacher or another student. A response was recorded as critical if the student went beyond the literal meaning, i.e., if he inferred, interpreted, extrapolated from the facts, detected logical fallacies in the material, or evaluated.

Two observations were made of each teacher. A lesson prepared by the teacher was taught during the first observation and a lesson prepared by the critical reading staff was taught during the second observation. Analysis of records of pupil responses revealed that the teachers did elicit critical responses from their pupils during the first lesson, but that the number of critical responses elicited was increased by the specially-designed lesson plans. The data were analyzed to determine the number of critical responses elicited by each type of question. The analysis showed that applying-evaluating questions were more effective for producing critical responses than questions used to gather information or refine and clarify information. Information-gathering questions were least effective for producing critical responses but seemed to be necessary in lessons directed toward critical reading.

Although the pilot observation study was not rigorously controlled and thus the results lack internal and external validity, certain trends and indications were noted which provided ideas for the subsequent phases of the critical reading study. For example, in order to obtain critical responses from pupils, it appeared necessary for teachers to establish a background of information early in the lesson. When teachers moved directly to applying-evaluative questions without establishing the substantive knowledge on a topic, they obtained

non-critical responses from a majority of the students. However, when teachers established a background of information and refined or clarified before asking applying-evaluative questions, critical responses were more likely to occur. A complete presentation of this study can be found in Appendix A.

It was impossible to classify all of the verbal behavior related to critical reading on the observation scale developed for the pilot study. Therefore, a new observation instrument was devised with expanded and more precise categories on both the teacher and pupil dimensions. This scale was revised through several preliminary observations of classrooms and the use of tape recorded discussions of reading material. A description of the observation instrument used in the experimental phase of the critical reading study is found in the following section.

Development of the Observation Instrument Used in the Study

The observation instrument used in the experimental study was also composed of two related category systems. Teachers' verbalizations were classified in one system, which was arranged vertically along the left side of the scale, and pupils' responses were coded in the other system, which was placed horizontally across the top of the scale (see Appendix E).

Bloom's (7) approach to ways of ordering knowledge was considered in developing the classification system for the teachers' verbal behavior. Inasmuch as teachers assume the primary role of structuring discourse in the classroom and are usually concerned with both content and process objectives when teaching reading, it was reasoned that the Bloom categories would be useful in coding the teachers' structure of the reading-discussion lessons. Not all of the categories identified by Bloom were used, and others were combined or re-named; however, his work was influential in defining each category. The eight teacher categories which consisted of gathering specific facts, clarifying, interpreting, analyzing, applying, summarizing, evaluating and controlling are defined in Appendix E.

The main criterion in determining the pupil categories was the differentiation of levels of thinking that were evident in the pupils' responses. Here the mental operations identified by Guilford (23) in his structure of the intellect proved useful in defining the separate types of thinking related to critical reading. Guilford (23) describes five major groups of intellectual abilities: memory, cognition, convergent and divergent thinking, and evaluation. These were adapted for this study and arranged in a continuum with random responses at Level 1, memory and cognition grouped into Level 2, convergent thinking designated as Level 3, divergent thinking as Level 4, and evaluative-

thinking as Level 5. Responses were recorded at the lower end of the continuum (Level 1) when they evidenced guessing or random thoughts. Responses that showed literal cognition, memory, or repeating information directly from the reading source or earlier discussions, were placed at the literal level (Level 2). When children made inferences, reorganized reading material or extended the material through appropriate illustrations, these responses were recorded at Level 3. Responses were placed in Level 4 when children generalized, theorized, or hypothesized, or made unique application of the material read. Level 5 was reserved for responses that showed pupils had made an evaluative judgment, based upon established criteria that were stated. Responses at Levels 4 and 5 were considered to be most closely related to the act of critical reading.

Development of Teaching Units

Twelve units were developed for the experimental phase of the study: six for the experimental groups and six for the control groups.

For each unit, background information was provided for the teacher. This information included an explanation of the unit content including its purposes, any unique features of the lesson plans, an explanation of difficult concepts, and any general teaching techniques running throughout all lesson plans in the unit. The lesson plans included a purpose statement, a list of the materials to be used, procedures to be followed and specific questions to be asked. Examples of these lessons are given in Appendix C.

The experimental teaching units were based on information obtained during the pilot observational study, on information in the literature, and on past experiences of members of the critical reading staff. Basic considerations in the teaching units were as follows: (1) the student should have a background for the concept being developed or the background should be provided in the lessons, (2) the lessons were gradated in difficulty and the concepts presented built on previous lessons, (3) questions purposely allowed for diversity of opinions, and (4) students were expected to substantiate their comments or answers with evidence.

Six teaching units were developed for the experimental groups: three suggested ways of working with informational and persuasive materials and three suggested ways of working with literary selections. Critical reading skills identified in the definition were grouped into the following teaching units: semantics, logic, general authenticity skills, literary form, components of literature, and literary devices.

The teaching units for the control groups followed a similar format but were not intended to develop evaluative reading skills.

The units for these groups used a wide variety of children's books to enrich the various areas of the curriculum including social studies, mathematics, creative arts, science and literature. For example, in the mathematics unit, children's books were used to help develop the concepts of number, shape, size, time, and measurement.

All of the teachers participated in the development of at least one of the lesson plans actually used. These teacher-prepared lessons were duplicated and distributed with the staff-prepared lessons. Because of the voluminous amount of lessons and materials to be developed for the experiment, it was necessary for the development to be continuous throughout most of the experimental phase.

Development of The Ohio State University Critical Reading Test

Since there was limited instrumentation in critical reading at the elementary school level, development of critical reading tests was necessary. Items were written to test many of the critical reading skills cited in the definition.

Due to the long list of critical reading skills and the practical problem of staying within reasonable time limits for elementary school children, not all of the skills listed in the definition could be tested. When two skills were similar, items were written for only one and only those skills seemingly appropriate to each grade level were included. Parallel items were written for each of the skills selected and were tested with readability formulas. Items were refined and selected for the trial forms on the basis of test specifications and criteria developed by The Test Development Center at The Ohio State University. The trial forms for the primary and intermediate grades were then administered in the spring to a national sample of 3017 children. Item analysis was performed on the results of this administration in order to select items for the final forms of the test. Criteria for the selection of items included level of item difficulty, balance among incorrect alternatives, and discriminating power. Several changes in vocabulary were made as a result of empirical evidence from the trial forms. The reliability of each form at each grade level was above .80 and was regarded as acceptable.

Development of Final Forms of the Critical Reading Test. Three forms of The Ohio State University Critical Reading Test (55) were developed from the items on the trial forms. The Level 2 Primary Critical Reading Test was intended to be used with children in grades two and three. The Level 1 Primary Test is basically the same test with a lower readability level and was developed to be used with the first grade children. The Intermediate form was intended for use in

grades four, five, and six. A 4.0 reading level is necessary to master the general reading mechanics of the Intermediate form. Sample items from the Primary and Intermediate forms are provided in Appendix D.

Norming Final Forms of the Critical Reading Test. The Test Development Center selected another national sample for the purpose of norming the tests. Forty-six school systems from four major geographical areas contributed to the normative sample. A random sampling was made of schools listed in the state educational directories. The states which contributed to the normative sample, with the number of schools and classes in parentheses after each state, were Idaho, (7:18); Louisiana, (4:10); Maine, (7:14); Minnesota, (6:16); Mississippi, (5:10); New Jersey, (6:16); Oklahoma, (4:9); and South Carolina, (7:20). The total number of students included in the fall norms is 3123 and in the spring norms is 1868. The means and standard deviation at each grade level obtained for the national sample are presented in Table 1.

TABLE 1

THE OHIO STATE UNIVERSITY CRITICAL READING TEST
MEANS AND STANDARD DEVIATIONS
NATIONAL SAMPLE

		Fall			Spring		
Test	Grade	N	Mean	Standard Deviation	N	Mean	Standard Deviation
Level 1 Primary	1	570	13.79	5.15	334	18.49	6.90
Level 2 Primary	2	485	13.88	5.52	321	17.72	6.79
Level 2 Primary	3	513	20.07	7.85	341	22.67	8.40
Intermediate	4	516	17.22	5.54	301	21.55	7.92
Intermediate	5	522	21.23	6.80	276	24.78	8.20
Intermediate	6	517	25.00	7.69	295	27.21	8.42

Reliability of the Final Forms. The Kuder-Richardson formulae 20 and 21 and the split-half coefficients were used to check the reliability of the tests at each grade level. These reliabilities as well as the standard error are given in Table 2 for the fall and spring administrations of the test.

TABLE 2

COEFFICIENTS OF RELIABILITY FOR THE OHIO STATE UNIVERSITY CRITICAL READING TESTS NATIONAL SAMPLE

		Fall							Spring						
Test	Grade	N	KR-20	St. Error	KR-21	St. Error	Od-Ev	St. Error	N	KR-20	St. Error	KR-21	St. Error	Od-Ev	St. Error
Level 1 Primary	1	570	.68	2.89	.67	2.97	.69	2.86	334	.82	2.90	.80	3.07	.84	2.77
Level 2 Primary	2	485	.71	2.99	.70	3.04	.70	3.04	321	.80	3.05	.78	3.18	.82	2.88
Level 2 Primary	3	513	.85	3.02	.83	3.19	.84	3.11	341	.87	2.98	.86	3.19	.89	2.79
Intermediate	4	516	.66	3.24	.63	3.37	.68	3.13	301	.83	3.29	.81	3.47	.82	3.39
Intermediate	5	522	.76	3.32	.74	3.50	.76	3.33	276	.84	3.31	.82	3.52	.83	3.39
Intermediate	6	517	.81	3.34	.79	3.54	.82	3.29	295	.85	3.30	.82	3.52	.83	3.50

Validity of the Final Forms. An attempt was made to determine the concurrent validity of the test six months after the experiment by asking teachers selected randomly from the control and experimental groups to list the five highest and five lowest critical readers in their group according to their judgment. Their ratings were compared to the ratings made from the scores on The Ohio State University Critical Reading Test. When the teacher judgments were compared with the results of the test, the teachers selected three of the five highest and two of the five lowest critical readers according to the test. The probability that this would occur by chance is .16 to .02 (hyper-geometric probability distribution). It is probable that the teachers' judgments would have more closely paralleled test results if the ratings had been made immediately following the experiment.

In the body of this report, data are presented which provide evidence of construct validity. Since the collection of data for construct validity was necessarily collected over a long period of time, it was done concurrently with the experimental phase. Correlational data presented in Chapter IV provide the evidence used to establish construct validity.

Factor Analysis of the Critical Reading Test. Factor analysis of the spring norms of The Ohio State University Critical Reading Test was done for the following purposes:

1. To clarify what the test measures.
2. To obtain factorial validity of the test.
3. To better understand the nature of critical reading.
4. To find specific areas in which the test needs improvement.

Hotelling's Principal Axis Method of factoring the correlation matrix was used in the first factor analysis. In view of the non-availability of outside criteria, it was decided to factor analyze the 42 X 42 matrix of inter-item correlations. This was accomplished through the use of the "OSU Factor Analysis Program (FACANA)" and The Ohio State University Computer Center's IBM 7094 computer. After twenty iterations, the entries in the residual matrix appeared to be small. The twenty factors thus obtained were then rotated according to Kaiser's Varimax Method. The first-grade data, which is illustrative of other grades, showed that (a) the total fractional contribution of the twenty factors is equal to .7090, and (b) the contribution of the first rotated factor is .0605 and that of each of the remaining nineteen factors varies between .03 and .04.

When the results obtained by the Principal Axis Method were examined, it was decided to study the data by using the Hierarchical Method in order to identify possible group factors. Since the factor analysis was not a part of this proposed study and is not yet finished, the results will be published elsewhere.

Experimental Phase

General Procedure

In the summer of 1965, before the experimental phase, two training workshops were conducted--one in critical reading and one in children's literature. Teachers for the study were volunteers from these workshops. In September, pretests in general reading and critical reading were administered to subjects in grades two through six. Each teacher was then given an experimental teaching unit (either critical reading or children's literature) and instructed to teach two lessons per week. The remaining units were periodically sent to the teachers throughout the year. Teachers were observed systematically during the teaching of the units and assistance was given to the teachers in both the experimental and control groups through individual conferences and two one-day training sessions in the fall and in the middle of the year. At the end of the academic year, the critical reading and general reading tests were administered again. Indications of intelligence and personality were obtained through tests administered in January (I.Q.) and May (Personality). The procedures for the subjects in grade one were the same except pretests of the criterion measures were administered in January. Since first-grade subjects in a pilot sample had difficulty reading the critical reading test, the test was read aloud to the first graders in the study while they followed along marking their answers. This procedure was repeated in May.

Sample

Subjects for the study consisted of 651*children in grades one through six from seven public school systems in Franklin County, Ohio. Twenty-four intact classroom groups were involved, four at each grade level. Two of the classes were assigned to the control group and two were assigned to the experimental group at each grade level. Since the study was to be conducted over an entire academic year, the teachers could not be selected randomly, but instead were chosen from teachers who attended the summer training workshops in 1965. The experimental teachers were chosen from the Critical Reading Workshop and the control teachers were chosen from the Children's Literature Workshop. Supervisors from The Ohio State University worked cooperatively with administrators in the Franklin County School Systems to identify potential teachers and to encourage them to attend the workshop and participate in the experiment.

Thirty-eight teachers volunteered from the Children's Literature Workshop and twenty-four volunteered from the Critical Reading Workshop. In selecting from among them, an attempt was made to choose teachers with classes from comparable socio-economic levels. For example, if in grade three one experimental group was from a high socio-economic

*An additional fifty-one students moved during the year and were dropped from the sample. This loss of 7 per cent is considerably lower than the normal 15 per cent in the entire Columbus Public School System.

area while another was from a low socio-economic area, the control groups were chosen accordingly. Tests of homogeneity of regression were conducted between the total treatment groups (two groups combined in each treatment) at each grade level on all of the criterion measures.* Except in two** cases out of thirty, the regressions were homogeneous, thus indicating that there was no sampling bias.

Design of the Study

The design for the analysis of the effects of the program of critical reading instruction at each grade level was a two factorial 2 X 2 (replications by treatment) pretest-posttest design. The technique utilized for analyzing the data was the analysis of covariance. The design was as follows:

R_1				R_2			
T_1		T_2		T_1		T_2	
X	Y	X	Y	X	Y	X	Y

where: R = Replication
T = Treatment
T_1 = Experimental
T_2 = Control
X = Covariate: pretest
Y = Variate: posttest

As mentioned previously, four intact classroom groups were studied at each grade level. Two of these groups were assigned to the control group and two were assigned to the experimental group. The subjects in the experimental group received instruction in critical reading while the subjects in the control group received instruction in children's literature in order to minimize the Hawthorne effect.

To assist in determining whether factors other than the treatment affected the results of the study, the investigators conceptualized the groups at each grade level as replication groups. There were two replications of this study at each grade level. Thus the research was conducted with one experimental and one control group (Replication one) and then repeated with another experimental and control group (Replication two).

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*All variables and tests are explained in the Instrumentation section.

**General reading in the second grade and the Literature sub-test of critical reading in the third grade.

Within treatments, the groups at each grade level were randomly assigned to replications. The analysis of replication differences provided a statistical measure of the experimental effect when the experiment was independently repeated.

In order to further control for initial differences, the technique of analysis of covariance was employed. Pretest measures were made on each subject to determine initial ability in critical reading and general reading. This score was used as a covariate of the posttest score. In this way, the effect of initial ability on the results was statistically eliminated.

Teaching Plan

The teaching plan for the experimental groups on most of the lessons included the following: (1) reading the materials, (2) discussing the factual content, (3) establishing the criteria for evaluating through discussion, illustrations, or questions, (4) asking students to use the criteria to evaluate the printed materials, and (5) assigning follow-up activities such as writing, comparing books, and searching for evidence. This sequence had been established through an earlier pilot observation study (see Appendix A) as one conducive to eliciting critical responses from children.

The teaching plan in logic differed somewhat from the rest since reading materials lending themselves to such analysis were scarce. Hence, these lessons were limited to the following activities: (1) establishing criteria for using logic in evaluation, (2) applying the criteria to worksheets and any available materials containing the various fallacies, (3) checking pupils' accuracy through questions and discussion, and (4) assigning follow-up activities again applying the criteria to the reading of other materials whenever it was possible.

The teaching plans for the control groups included the following: (1) reading the materials, (2) discussing the factual content, (3) asking children to relate the story to the content area of the units, e.g., mathematics, and (4) assigning follow-up activities such as writing and additional reading. Thus, the format of the teaching plans for all groups was the same except that in the experimental group criteria for evaluating were established, and the questions and activities required the children to use the criteria to evaluate printed materials.

Instrumentation

The tests other than The Ohio State University Critical Reading Test administered to all subjects were as follows:

(1) California Achievement Tests in Reading (51), Form W in the fall and Form X in the spring. Scores were obtained on Total and on Vocabulary and and Comprehension;

(2) The Lorge-Thorndike Intelligence Tests (28), Levels 1 and 2, Form A for grades one and two and Levels A-D, Form 1 for grades three through six. This test provides a measure on non-verbal ability for all six grade levels and a measure of verbal ability for all grades except one and two;

(3) The California Test of Personality (50), Primary Form AA for grades one, two, and three and Elementary Form AA for grades four, five, and six. Scores used on this test were Personality Total and the subscores of Personal and Social Adjustment.*

The reliabilities of the standardized tests and the method by which they were obtained are given in Table 3. All instruments were administered in groups.

The criterion instruments for critical reading were the tests developed by the project staff. Four scores were obtained on the critical reading test--a total score and scores from items grouped into three sections: Logic, General and Literature. The items that tested the subject's ability to detect fallacies and propaganda techniques used in printed materials and his ability to evaluate the internal consistency of an argument were labeled as Logic. Items that evaluated the subject's ability to identify the author's and publisher's point of view and biases, to judge the author's qualifications and to make comparisons of related content from various sources were categorized as General. Items measuring the subject's ability to identify literary forms and to analyze and evaluate story structure, character development, story setting, format and theme of the story and the author's use of literary devices were classified under Literature. The total number of items for the critical reading test and its sections were as follows:

	Logic	General	Literature	Total
Level 1 Primary	17	10	15	42
Level 2 Primary	17	12	17	46
Intermediate	21	15	18	54

*At the request of the test committee of the U. S. Office of Education, several items on family relationships were deleted from the Social Adjustment section of the test.

TABLE 3

RELIABILITY OF STANDARDIZED TESTS USED IN THE STUDY

	Lorge-Thorndike Intelligence Nonverbal[1]		Lorge-Thorndike Intelligence Verbal[2]		California Achievement Tests in Reading[3]		California Test of Personality[4]			
							Tot.		P. Adj.	S. Adj.
Grade	Measure	Rel.	Measure	Rel.	Measure	Rel.	Measure	Rel.	Rel.	Rel.
1	Alt. form	.81	No test	---	KR-21	.88	KR	.88	.83	.80
2	Alt. form	.76	No test	---	KR-21	.93	KR	.88	.83	.80
3	None reported	---	None reported	---	KR-21	.93	KR	.88	.83	.80
4	Test - Retest	.75	Test - Retest	.58	KR-21	.93	KR	.94	.93	.92
5	Odd - Even	.94	Odd - Even	.94	KR-21	.95	KR	.94	.93	.92
6	None reported	---	None reported	---	KR-21	.95	KR	.94	.93	.92

[1] Irving Lorge and Robert Thorndike, The Lorge-Thorndike Intelligence Tests, Technical Manual (Boston: Houghton Mifflin Company, 1962), pp. 8-10.

[2] Ibid.

[3] California Achievement Tests in Reading, Technical Report (California Test Bureau, 1957), pp. 21-23.

[4] L. P. Thorpe, W. W. Clark, and E. W. Tiegs, California Test of Personality, Manual (1953), p. 4.

Observations

In order to determine what types of teacher questions produced critical responses from subjects, six observations were made at regular intervals in each of the twenty-four classrooms resulting in a total of 144 observation records. Three observers were trained to use the observation scale (described on pages 24 and 25) through repeated visits to classrooms and extensive use of tape recordings. On-the-spot categorization was made of both the teacher's verbal expressions and the pupils' responses. Inter-observer reliability was checked periodically by the Spearman-Brown Prophecy Formula. Coefficients for the teacher categories ranged between .67 and .97 with a mean of .84 while inter-observer reliability for pupil categories ranged between .61 and .87 with a mean of .73. Two observers participated in each observation. While one observer classified the verbal behavior of both teachers and pupils, the other kept a companion record that identified by number and sex each pupil who spoke. This coding provided data about the number of different pupils who participated in the discussions and the degree of participation of each of the sexes. The teachers were informed of the observations in advance and the time of each observation was limited to twenty-five minutes.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The presentation and analysis of the data from this study are given in this chapter in three major sections: the feasibility of teaching critical reading, factors related to the ability to read critically and observations of the verbal interaction during critical reading lessons. The final section of the chapter presents the teachers' reactions to teaching critical reading.

Feasibility of Teaching Critical Reading

The major purpose of the study was to determine whether or not children in the elementary grades could be taught to read critically while normal progression in other basic reading skills was maintained. In order to answer this question, data including the scores from the criterion measures of critical reading and general reading were analyzed using the technique of analysis of covariance (ANCOVA). Results are reported here for the total scores on The Ohio State University Critical Reading Test (hereafter called Critical Reading Total) and the California Achievement Test in Reading (hereafter called General Reading Total) as well as the sub-test scores of Logic, General, and Literature from the critical reading test. The complete ANCOVA tables for these data are presented in Appendix F. The data on treatment, replication and interaction effects at each grade level are presented first with differences across grade levels reported immediately following. There are several instances where replication or interaction effects occur in the data. These effects indicate that there was some source of variation, other than the treatment, throughout many of the grades. An explanation of the interaction effects is given on page 46. Summaries are also presented for the data at each grade level on page 48 and for the data across grade levels on page 55.

Analysis of Scores on Criterion Measures at Each Grade Level

Grade One. The mean score of the experimental group on the Critical Reading Total was significantly higher ($p < .01$) than that of the control group. This is shown by the F tests from the analysis of covariance presented in Table 5. The unadjusted means and gains on the criterion measures for grade one are presented also in Table 4. No main effect of replications was observed; however, there was a significant replication by treatment interaction ($p < .01$) due mainly to the high scores of the control group in Replication one.

On the sections of the critical reading test, the experimental group scored significantly higher ($p < .01$) than the control group on Logic. They also scored higher on Literature but at a marginal level of significance ($p < .10$) while the control group scored higher ($p < .10$) on the General section. The main effect due to replications on the Logic scores indicates that there was some source of variation, not due to the treatment, between the groups on this sub-test. The interaction effects occurring on the three sections of The Ohio State University Critical Reading Test are due mainly to the high scores of the control group in Replication one.

The experimental group also scored higher ($p < .10$) than the control group on the General Reading Total, but there was both a significant replications effect ($p < .01$) and a significant replication by treatment interaction ($p < .01$) again due to the high mean score of the control group in Replication one.

Thus in grade one, the children who were given instruction in critical reading did better on the critical reading test than the children who did not receive such instruction. However, the significant replication and interaction effects that were observed indicate there was some source of variation causing one control group to make consistently high mean scores on the tests.

Grade Two. The experimental group also had a higher mean score than the control group on the Critical Reading Test Total in grade two; however, the difference was at a marginal level of significance ($p < .10$). Table 6 contains the unadjusted means and gains on the criterion measures and Table 7 contains the F tests from the analysis of covariance for these data. It can be observed in the F table that there was neither a main effect due to replications nor a significant interaction effect on the Critical Reading Test Total.

The differences between the scores of the experimental and the control groups were not significant on either the General or Literature sections of the critical reading test at this grade level. Only on the Logic section of the test did the experimental group score significantly higher ($p < .01$) than the control group. There was also a replications

TABLE 4

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE ONE

	Replication		Treatment	
	R_1	R_2	T_1(Exper.)	T_2(Control)
CRITICAL READING TOTAL				
Pretest	13.24	13.13	12.98	13.38
Posttest	18.15	19.78	20.14	17.66
Gain	4.91	6.65	7.16	4.28
Logic Section				
Pretest	5.85	4.76	4.70	6.00
Posttest	7.04	8.26	8.64	6.56
Gain	1.19	3.50	3.94	.56
General Section				
Pretest	3.04	3.13	3.24	2.92
Posttest	4.43	3.87	3.84	4.50
Gain	1.39	.74	.60	1.58
Literature Section				
Pretest	4.35	5.22	5.04	4.46
Posttest	6.69	7.65	7.66	6.60
Gain	2.34	2.43	2.62	2.14
GENERAL READING TOTAL				
Pretest	49.76	40.76	52.10	39.14
Posttest	65.04	62.76	71.24	56.74
Gain	15.28	22.00	19.14	17.60

TABLE 5

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE ONE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	2.65	6.91*	1.97	1.55	8.74**
Treatment	7.66**	19.61**	3.63[a]	3.42[a]	3.80[a]
Rep. by Treat.	25.75**	18.28**	7.10**	41.43**	29.86**

[a]Significant at the .10 level
*Significant at the .05 level
**Significant at the .01 level

TABLE 6

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE TWO

	Replication		Treatment	
	R_1	R_2	T_1 (Exper.)	T_2 (Control)
CRITICAL READING TOTAL				
Pretest	16.36	15.67	16.75	15.41
Posttest	22.90	23,48	24.74	22.08
Gain	6.54	7,81	7.99	6.67
Logic Section				
Pretest	5.92	5.68	6.26	4.54
Posttest	7.76	8.45	9.36	7.30
Gain	1.84	2.77	3.10	2.76
General Section				
Pretest	4.68	4.90	4.81	4.79
Posttest	6.08	6.30	6.36	6.08
Gain	1.40	1.40	1.55	1.29
Literature Section				
Pretest	5.76	6.03	5.68	6.08
Posttest	9.06	8.65	9.02	8.70
Gain	3.30	2.62	3.34	2.62
GENERAL READING TOTAL				
Pretest	65.74	69.85	67.98	67.03
Posttest	83.34	81.80	81.77	83.13
Gain	17.60	11.95	13.79	16.10

TABLE 7

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE TWO

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	.92	5.90*	.21	.70	9.77**
Treatment	3.65[a]	11.73**	.45	.54	1.71
Rep. by Treat.	.35	.10	.08	.86	.13

[a]Significant at the .10 level
*Significant at the .05 level
**Significant at the .01 level

effect ($p < .01$) but no interaction effect.

On the General Reading Test Total, there was no significant difference between the experimental and control groups. Although there was no interaction effect, there was a significant main effect of replications ($p < .01$).

In summary, the children in the experimental group in grade two did significantly better than the children in the control group on the Logic sub-test of critical reading. They also had a higher mean score on the Critical Reading Total, but at a marginal level of significance. The significant replication effects on Logic and General Reading Total indicate that some factor other than the treatment caused differences between replications.

Grade Three. The experimental group scored significantly higher ($p < .01$) than the control group on the Critical Reading Total (see Tables 8 and 9). There was no difference between replications but a significant interaction effect ($p < .01$) occurred. This interaction was due to the high scores of the control group in Replication two.

This was the only grade level at which the experimental groups scored significantly higher than the control groups on each of the sections of the critical reading test. There was a significant difference ($p < .05$) between replications only on the General section, but interaction effects ($p < .01$) occurred on each section. In each case the interaction was due to the high scores of the control group in Replication two.

There were no differences between treatments or between replications on the General Reading Total but a significant interaction effect ($p < .01$) was observed. The significant interaction effect was again due to the high scores of the control group in Replication two.

In grade three, the children who had received instruction in critical reading did significantly better on the critical reading test than the children who had not received such instruction. The significant interaction effects and the main effect of replications on the General Reading and Critical Reading Totals mean that there was some factor other than the treatment causing the control group in Replication two to receive consistently higher scores than the other groups.

Grade Four. In grade four (see Tables 10 and 11) the experimental group also had a significantly higher ($p < .05$) mean score on the Critical Reading Test Total than the control group. However, there was a significant effect due to replication and interaction. These effects were due to the low scores of the experimental group in Replication two.

TABLE 8

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE THREE

	Replication		Treatment	
	R_1	R_2	T_1(Exper.)	T_2(Control)
CRITICAL READING TOTAL				
Pretest	21.21	18.78	21.37	18.32
Posttest	26.75	24.12	28.80	21.98
Gain	5.54	5.34	7.43	3.66
Logic Section				
Pretest	7.47	6.53	7.35	6.57
Posttest	10.00	9.29	11.10	7.99
Gain	2.53	2.76	3.75	1.42
General Section				
Pretest	5.83	5.24	5.96	5.04
Posttest	7.21	6.02	7.21	5.88
Gain	1.38	.78	1.25	.84
Literature Section				
Pretest	7.87	7.02	8.06	6.71
Posttest	9.51	9.20	10.49	8.11
Gain	1.64	2.18	2.43	1.40
GENERAL READING TOTAL				
Pretest	52.95	65.74	72.58	55.34
Posttest	64.00	78.80	80.71	73.94
Gain	11.05	13.06	7.13	18.60

TABLE 9

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE THREE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	.34	.88	6.20*	.14	.63
Treatment	22.15**	46.38**	5.52*	8.52**	1.56
Rep. by Treat.	9.80**	14.88**	14.80**	16.85**	15.57**

*Significant at the .05 level
**Significant at the .01 level

TABLE 10

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE FOUR

	Replication		Treatment	
	R_1	R_2	T_1 (Exper.)	T_2 (Control)
CRITICAL READING TOTAL				
Pretest	15.79	15.36	14.87	16.50
Posttest	18.52	16.61	17.88	17.22
Gain	2.73	1.25	3.01	.72
Logic Section				
Pretest	6.06	5.48	5.82	5.92
Posttest	7.92	6.55	7.64	6.89
Gain	1.86	1.07	1.82	.97
General Section				
Pretest	4.61	4.46	4.13	4.96
Posttest	4.97	4.50	4.74	4.76
Gain	.36	.04	.61	-.20
Literature Section				
Pretest	5.15	5.41	4.92	5.62
Posttest	5.63	5.43	5.50	5.57
Gain	.48	.02	.58	-.05
GENERAL READING TOTAL				
Pretest	54.13	48.77	44.73	56.78
Posttest	69.77	59.00	59.85	69.64
Gain	15.64	10.23	15.12	12.86

TABLE 11

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE FOUR

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	5.54*	9.65**	1.50	.46	6.19*
Treatment	4.16*	3.60[a]	.56	.12	.01
Rep. by Treat.	10.11**	16.97**	3.60	1.58	9.44**

[a]Significant at the .10 level
*Significant at the .05 level
**Significant at the .01 level

Although there were no differences on the General or Literature sections of the critical reading test in grade four, the experimental group did score higher (marginal significance level $p < .10$) on the Logic section than the control group. On the Logic section there was also a significant difference ($p < .01$) between replications and a significant interaction effect ($p < .01$). This was due to the low scores of the experimental group in Replication two.

There was no difference between the mean scores of the experimental group and the control group on the General Reading Total; however, there were significant effects due to replication ($p < .05$) and to interaction ($p < .01$). Again, this was due to the low scores of the experimental group in Replication two.

Accordingly, the children in the fourth grade experimental group did better than the control group on the Critical Reading Test Total and the Logic sub-test of critical reading. At the same time, they did as well as the children in the control group on the general reading test. It still remains necessary to explain the interaction effects, i.e., why the experimental group in Replication two received relatively low scores.

Grade Five. The mean score of the experimental group on the Critical Reading Total was significantly higher ($p < .01$) than that of the control group in grade four (see Tables 12 and 13), but there was a significant effect ($p < .05$) due to replications.

On the sections of the critical reading test, the experimental group scored significantly higher ($p < .01$) than the control group only on Logic. Replication effects ($p < .01$) occurred only on the General section while interaction effects ($p < .05$) were observed in both the Logic and General sections. In the Logic section, the interaction was due mainly to the high scores of the control group in Replication one while in the General section the interaction was due to the low scores of the experimental group in Replication one.

There were no effects due to treatment on the General Reading Test Total, but a significant replications effect ($p < .05$) occurred.

Thus in grade five, the children who had received instruction in critical reading did better on the Critical Reading Test Total and the Logic section than the children who had not received such instruction. However, the significant replication and interaction effects indicate that there was some source of variation confounding the results.

Grade Six. Although the experimental group in grade six scored higher than the control group on the Critical Reading Test Total, it was at a marginal level of significance ($p < .10$). The unadjusted means and gains on the criterion measures for this grade are reported in Table 14 and the F tests from the analysis of covariance for these data are presented in Table 15 . As may be observed in these tables,

TABLE 12

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE FIVE

	Replication		Treatment	
	R_1	R_2	T_1 (Exper.)	T_2 (Control)
CRITICAL READING TOTAL				
Pretest	21.96	21.44	20.33	23.34
Posttest	25.62	27.80	26.75	26.79
Gain	3.66	6.36	6.42	3.45
Logic Section				
Pretest	8.00	8.10	7.70	8.32
Posttest	10.13	10.85	11.69	9.25
Gain	2.13	2.75	3.99	.93
General Section				
Pretest	7.49	6.89	6.73	7.43
Posttest	7.45	8.38	7.33	8.59
Gain	-.04	1.49	.60	1.16
Literature Section				
Pretest	6.47	6.95	5.90	7.59
Posttest	8.04	8.57	7.73	8.95
Gain	1.57	1.62	1.83	1.36
GENERAL READING TOTAL				
Pretest	89.45	76.79	77.62	88.34
Posttest	93.82	89.38	88.28	94.91
Gain	4.37	12.59	10.66	6.57

TABLE 13

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE FIVE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	5.46*	.55	9.69**	.21	6.85*
Treatment	7.11**	26.93**	1.82	.04	.67
Rep. by Treat.	.94	5.43*	3.99*	.13	.44

*Significant at the .05 level
**Significant at the .01 level

TABLE 14

UNADJUSTED MEANS AND GAINS ON GENERAL AND CRITICAL READING TESTS GRADE SIX

	Replication		Treatment	
	R_1	R_2	T_1 (Exper.)	T_2 (Control)
CRITICAL READING TOTAL				
Pretest	25.83	20.31	22.55	24.23
Posttest	29.83	26.58	28.67	27.91
Gain	4.00	6.27	6.12	3.42
Logic Section				
Pretest	10.09	7.73	8.70	9.32
Posttest	11.47	11.16	11.99	10.52
Gain	1.38	3.43	3.29	1.20
General Section				
Pretest	8.13	6.24	7.10	7.44
Posttest	9.09	7.64	8.49	8.38
Gain	.96	1.40	1.39	.94
Literature Section				
Pretest	7.79	6.31	6.75	7.47
Posttest	9.25	7.64	8.19	9.01
Gain	1.46	1.33	1.44	1.54
GENERAL READING TOTAL				
Pretest	94.42	76.38	86.18	86.19
Posttest	100.51	88.89	95.35	94.98
Gain	6.09	12.51	9.17	8.79

TABLE 15

F TESTS FROM THE ANALYSIS OF COVARIANCE GRADE SIX

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	2.33	2.33	.00	1.51	.50
Treatment	3.75[a]	6.53*	.52	.75	.03
Rep. by Treat.	.26	1.03	.46	.18	.81

[a]Significant at the .10 level
*Significant at the .05 level

there were no differences on either the General or Literature sections of the critical reading test; but the experimental group did score significantly higher ($p < .05$) than the control group on the Logic section. As was true in most of the other grades, no differences were found on the General Reading Total scores for grade six.

Explanation of the Replication by Treatment Interactions. As mentioned in the Procedures Chapter, intact classroom groups were used in the sample. Since the study was conducted over an entire academic year, it was impossible to choose classrooms randomly, but instead teachers were chosen from among volunteers. This made it necessary to control for initial differences in the groups; therefore, the technique of analysis of covariance was employed. Prior to using this technique, a check was made on the comparability of the regression lines of the combined treatment groups. This test showed that the regressions were homogeneous thus indicating that there was no sampling bias and that all main effects of treatment observed are due to the experimental manipulations and not to other sources of variation. As a further check on sampling differences, the covariance design employed divided the groups into two replications. Each of the experimental and control groups was randomly assigned to a replication. When the data were analyzed, a number of replication by treatment (R x T) interactions occurred. These interactions could have been due to intelligence, teachers' ability or some other uncontrolled variable.

Because intelligence scores for each group were available, Newman Keuls multiple range tests were applied to the I.Q. means at each grade level to determine whether this factor might have contributed to the R x T interactions. It appears from an inspection of Table 16 that many of the interactions are due to intelligence differences. An explanation of these interactions at each grade level is given below.

In grade one where R x T interactions occurred on every criterion measure, the I.Q. mean of the control group in Replication one was significantly higher than that of the experimental group in Replication one. An inspection of the interactions shows that it was the high scores on the criterion measures in that group that made the main contribution to the interaction.

There were no I.Q. differences in grade two and there were no R x T interactions. In grade three, where there were R x T interactions on every criterion test, the interactions were due to the low scores made by the control group in Replication one and the fairly high scores of the control group in Replication two on the criterion measures. Multiple range tests indicated that the mean I.Q. score of the former group was significantly lower than the mean I.Q. scores of all the other groups at that grade level while the mean I.Q. score of the other control group was higher than one experimental group but equal to that of the other experimental group. A comparison of the mean scores on the criterion measures between this control group and the two experimental

groups shows that the experimental group with equal I.Q. scores had a higher mean while the experimental group with lower I.Q. scores had a lower mean.

Interactions occurred on the criterion measures of General Reading Total, Critical Reading Total and the Logic section of the critical reading test in grade four. These interactions were due to the extremely low mean scores of one experimental group. When the mean intelligence score for this group was examined, it was determined that the group had a significantly lower I.Q. score than did any of the other three groups. There were no differences in the I.Q. scores among the other three groups.

In grade five, interactions occurred on only two criterion measures--the Logic and General sections of the critical reading test. Since there were no I.Q. differences among the groups at that grade level, the differences may be attributable to teacher ability or some other uncontrolled factor.

No interactions occurred in grade six; however, the mean I.Q. scores of the experimental group in Replication two were lower than the I.Q. scores of the other three groups. It is interesting to note, however, that the mean I.Q. of that group was 96.15. Since the mean I.Q. fell in the middle range it appeared to make little difference.

TABLE 16

I.Q. MEANS FOR ALL GROUPS

Grade	Replication 1 Experimental	Replication 1 Control	Replication 2 Experimental	Replication 2 Control
1	106.08	116.11	116.29	91.55
2	108.33	99.48	106.04	98.74
3	119.07	84.62	91.91	116.89
4	103.68	98.56	89.81	101.67
5	102.73	109.10	105.76	106.52
6	106.55	107.50	96.15	102.32

Summary of the ANCOVA Data for Each Grade. A visual summary of the results of the analysis of covariance for each grade level is presented in Table 17. This table shows that the mean scores of the experimental group were significantly higher on the Critical Reading Test Total than those of the control group at every grade level. However, the differences were at a marginal level of significance in grades two and six.

When the sections of the critical reading test were used as the criterion measures, Logic was the only one on which the experimental group scored consistently higher than the control group. The mean scores of the experimental group on this section were significantly higher at all grade levels with the exception of grade four where the difference was at a marginal level of significance. In contrast, there were no differences on the General section of the test in grades two, four, five, and six. In grade one, the control group scored higher than the experimental group on this section while in grade three the experimental group scored higher. On the Literature section, there were again no differences between the treatment groups in grades two, four, five, and six. The experimental group did better than the control group on this section both in grades one and three; however, the difference was at a marginal level of significance in grade one.

On the General Reading Test Total, there were no differences between treatment groups except in grade one where the experimental group had significantly higher mean scores than the control group.

Thus the analysis of covariance data show that children who received instruction in critical reading did better on the Critical Reading Test Total and the Logic section than children who had not received such instruction. At the same time, they did as well as the children in the control group on the general reading test at most grade levels and better than the control group in the first grade.

Several differences between replications were found for the critical reading and general reading tests. These differences occurred on the Critical Reading Total in grades four and five; on the Logic section in grades one, two and four; on the General section in grades three and five; and on the General Reading Test Total in grades one, two, four and five. Only on the Literature section did no replication differences occur.

There were also a number of replication by treatment interactions. These interactions occurred on every criterion measure in grades one and three; on the Critical Reading Total, Logic and General Reading Total in grade four; and on the Logic and General sections in grade five. No interactions occurred in grades two and six.

The replication differences and the interactions show that there was some factor other than the treatment affecting the differences

TABLE 17

A VISUAL SUMMARY OF DIFFERENCES BETWEEN REPLICATIONS AND BETWEEN TREATMENTS AT EACH GRADE LEVEL ON GENERAL AND CRITICAL READING TESTS

	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
CRITICAL READING TOTAL	$R_1 = R_2$	$R_1 = R_2$	$R_1 = R_2$	$R_1 > R_2$*	$R_1 < R_2$*	$R_1 = R_2$
	$T_1 > T_2$**	$T_1 > T_2$[a]	$T_1 > T_2$**	$T_1 > T_2$*	$T_1 > T_2$**	$T_1 > T_2$[a]
Logic Section	$R_1 < R_2$*	$R_1 < R_2$*	$R_1 = R_2$	$R_1 > R_2$**	$R_1 = R_2$	$R_1 = R_2$
	$T_1 > T_2$**	$T_1 > T_2$**	$T_1 > T_2$**	$T_1 > T_2$[a]	$T_1 > T_2$**	$T_1 > T_2$*
General Section	$R_1 = R_2$	$R_1 = R_2$	$R_1 > R_2$*	$R_1 = R_2$	$R_1 < R_2$**	$R_1 = R_2$
	$T_1 < T_2$[a]	$T_1 = T_2$	$T_1 > T_2$*	$T_1 = T_2$	$T_1 = T_2$	$T_1 = T_2$
Literature Section	$R_1 = R_2$	$R_1 = R_2$	$R_1 = R_2$	$R_1 = R_2$	$R_1 = R_2$	$R_1 = R_2$
	$T_1 > T_2$[a]	$T_1 = T_2$	$T_1 > T_2$**	$T_1 = T_2$	$T_1 = T_2$	$T_1 = T_2$
GENERAL READING TOTAL	$R_1 < R_2$**	$R_1 > R_2$**	$R_1 = R_2$	$R_1 > R_2$*	$R_1 < R_2$*	$R_1 = R_2$
	$T_1 > T_2$[a]	$T_1 = T_2$	$T_1 = T_2$	$T_1 = T_2$	$T_1 = T_2$	$T_1 = T_2$

T_1 = Experimental; T_2 = Control

[a]Significant at the .10 level
*Significant at the .05 level
**Significant at the .01 level

between groups. An analysis indicates that I.Q. differences caused many of the interactions. Those groups with I.Q. scores significantly higher than the other groups at a particular grade level tended to make higher scores on the criterion measures while those groups with I.Q. scores significantly lower than the other groups tended to make lower scores. The interactions in grade five and the replication effects remain unexplained, but may be due to differences in teacher ability on certain critical reading skills such as the use of logical reasoning.

Differences Across Grade Levels

In order to make comparisons across grade levels, analysis of covariance tests were run on the scores of the criterion measures of general reading and critical reading wherever possible. The analysis was limited to a comparison of those scores where subjects from different grade levels had taken the same forms of each test. Thus comparisons were made of first and second-grade subjects on the general reading test only, second and third-grade subjects on the critical reading test only, and fourth, fifth, and sixth-grade subjects on both the general reading and critical reading tests. The analysis of covariance design involved the factors of replication, grade, and treatment.

Grades One-Two. Table 19 presents the F's from the analysis of covariance of the scores on the general reading tests for subjects in grades one and two and Table 18 presents the main effect means. It may be observed from these tables that the subjects in grade two did significantly better than those in grade one on the General Reading Test Total and that subjects in the experimental group did significantly better than those in the control group.

Although there was no difference between replications, all interaction effects were significant. The replication by grade interaction was due to the high scores of grade one subjects in Replication two and of grade two subjects in Replication one. There was a replication by treatment interaction because subjects in the experimental group did better in Replication two than in Replication one while the converse was true of subjects in the control group. The grade by treatment interaction was due to the fact that the experimental group did better than the control group in grade one while there was no significant difference between treatment groups in grade two. The interaction of replication by grade by treatment was due to a combination of the above effects.

Grades Two-Three. The analysis of scores of subjects in grades two and three (see Tables 20 and 21) on the Critical Reading Total shows no main effect of either replication or grade. However, the mean score of the experimental group on the Critical Reading Total was significantly higher than that of the control group. The significant replication by treatment interaction is due to the fact that subjects

TABLE 18

UNADJUSTED MEANS ON THE GENERAL READING TEST TOTAL BY REPLICATION, TREATMENT, AND GRADE FOR GRADES ONE-TWO

	Replication		Treatment		Grade	
	R_1	R_2	T_1	T_2	G_1	G_2
GENERAL READING TEST TOTAL						
Pretest	57.44	57.23	59.79	55.22	45.62	67.44
Posttest	73.87	73.54	76.34	71.43	63.99	82.55
Gain	16.43	16.31	16.55	16.21	18.37	15.11

TABLE 19

F TESTS FROM ANALYSIS OF COVARIANCE FOR TABLE

Source	GENERAL READING TEST Total
Replication	.63
Grade	17.83**
Treatment	5.39*
Rep. x Grade	6.92**
Rep. x Treat.	62.14**
Grade x Treat.	17.36**
Rep. x Grade x Treat.	32.58**

*Significant at the .05 level
**Significant at the .01 level

TABLE 20

UNADJUSTED MEANS ON THE CRITICAL READING TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES TWO-THREE

	Replication		Treatment		Grade	
	R_1	R_2	T_1	T_2	G_2	G_3
CRITICAL READING TOTAL						
Pretest	18.85	16.98	19.32	16.51	15.98	19.69
Posttest	24.14	23.99	27.00	22.03	23.22	25.56
Gain	5.29	7.01	7.68	5.52	7.24	5.87
Logic Section						
Pretest	6.72	5.62	6.86	5.46	5.42	6.97
Posttest	8.91	8.86	10.28	7.61	8.36	9.62
Gain	2.19	3.24	3.47	2.15	2.94	2.65
General Section						
Pretest	5.27	5.07	5.44	4.91	4.80	5.52
Posttest	6.66	6.16	6.84	5.98	6.20	6.58
Gain	1.39	1.09	1.40	1.07	1.40	1.06
Literature Section						
Pretest	6.84	6.52	7.00	6.37	5.91	7.42
Posttest	9.29	8.92	9.84	8.41	8.84	9.35
Gain	2.45	2.40	2.84	2.04	2.93	1.93

TABLE 21

F TESTS FROM ANALYSIS OF COVARIANCE FOR TABLE

	CRITICAL READING			
	Total	Logic	General	Literature
Replication	.05	1.27	2.55	.36
Grade	.89	4.67*	.06	.68
Treatment	21.09**	52.98**	5.79*	7.85**
Rep. x Grade	1.01	5.43*	3.00	1.59
Rep. x Treat.	6.10*	15.83**	11.31**	16.55**
Grade x Treat.	4.73*	7.01**	1.90	2.40
Rep. x Grade x Treat.	17.51**	13.77**	19.27**	18.92**

*Significant at the .05 level
**Significant at the .01 level

in the experimental group did better in Replication one than Replication two while the opposite was true for the control group. There was a significant grade by treatment interaction. Although experimental subjects in both grades scored higher than control subjects, the difference between treatments in grade three was higher than the difference between treatments in grade two. The R x G x T interaction is due to the effect of treatment across grades and replications.

On the Logic section of the critical reading test, there was no significant difference between replications, but there were main effects of grade and treatment. Subjects in grade three scored significantly higher than subjects in grade two and subjects in the experimental group performed significantly better than subjects in the control group. All interactions were significant. The replication by grade interaction was due to the fact that the subjects in grade one did better in Replication two than in Replication one while the reverse was true of subjects in the control group. There was a replication by treatment effect because subjects in the experimental group did better in Replication one than in Replication two. The grade by treatment interaction was due to the fact that experimental subjects in grade two did better than those in grade one while there was no difference between control groups in grades one and two. The replication by grade by treatment interaction was due to a combination of the above interactions.

On the General section of the critical reading test there was no difference between replications or between subjects in grades two and three. Subjects in the experimental group did significantly better on this section than the subjects in the control group. The only interaction, replication by treatment, was due to the fact that experimental subjects in Replication one scored significantly better than those in Replication two while the opposite was true with subjects in the control group.

On the Literature sub-test, there was no main effect of either replications or grades. However, the subjects in the experimental group scored significantly higher than those in the control group. The significant replication by treatment interaction was due mainly to the fact that subjects in the experimental group scored higher in Replication one than Replication two while the converse was true of subjects in the control groups. The significant replication by grade by treatment interaction is mainly due to the main effect of treatment and the interaction of replication by treatment across grade levels.

Grades Four-Five-Six. Table 22 presents the main effect means and Table 23 presents the F tests for the analysis of the scores of subjects in grades four, five, and six on the criterion measures of Critical Reading Total; the sub-tests of Logic, General, and Literature; and General Reading Total.

The significant main effect of grade was due to the fact that while there was no difference between the subjects in grades five and six both groups scored higher than subjects in grade four. Subjects

TABLE 22

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

	Replication		Treatment		Grade		
	R_1	R_2	T_1	T_2	G_4	G_5	G_6
CRITICAL READING TOTAL							
Pretest	20.92	19.03	19.03	21.06	15.59	21.69	23.29
Posttest	24.34	23.56	24.32	23.56	17.56	26.77	28.34
Gain	3.42	4.53	5.29	2.50	1.97	5.08	5.05
Logic Section							
Pretest	7.95	7.09	7.31	6.98	5.86	8.00	8.97
Posttest	9.74	9.45	10.38	8.73	7.27	10.51	11.34
Gain	1.79	2.36	3.07	1.75	1.41	2.51	2.37
General Section							
Pretest	6.64	5.87	5.92	6.65	4.54	7.17	7.27
Posttest	7.06	6.83	6.80	7.11	4.74	7.94	8.43
Gain	.42	.96	.88	.46	.20	.77	1.16
Literature Section							
Pretest	6.40	6.24	5.86	6.83	5.27	6.72	7.11
Posttest	7.53	7.23	7.09	7.71	5.53	8.32	8.51
Gain	1.13	.99	1.23	.88	.26	1.60	1.40
GENERAL READING TOTAL							
Pretest	78.11	66.31	69.03	75.99	50.65	82.79	86.18
Posttest	87.14	78.74	80.75	85.59	64.66	91.48	95.18
Gain	9.03	12.43	11.72	9.60	14.01	8.69	9.00

TABLE 23

F TESTS FROM ANALYSIS OF COVARIANCE FOR TABLE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Replication	1.06	.00	.67	.71	.40
Grade	14.22**	15.41**	21.11**	19.51**	1.48
Treatment	17.54**	34.27**	.21	.12	.31
Rep. x Grade	5.12*	3.69*	5.63*	1.10	8.65**
Rep. x Treat.	.20	.20	.01	.33	9.39**
Grade x Treat.	.09	3.40	1.71	.78	.36
Rep. x Grade x Treat.	3.48*	8.20**	3.36*	.63	2.79

*Significant at the .05 level
**Significant at the .01 level

in the experimental groups also scored significantly higher than those in the control groups. Although there was no replications effect, there was a grade by replication interaction due to the fact that subjects in grade five did better in Replication two than Replication one while the reverse was true of subjects in grades four and six. The significant R x G x T was due to the combined effects of grade differences, treatment differences, and the grade by replication interaction.

On Logic, subjects in grade five scored the same as subjects in grade six who, in turn, scored significantly higher than grade four subjects. Subjects in the experimental group did significantly better than those in the control group and there was no difference between replications. The replication by grade interaction was due to the fact that both grades five and six subjects did better on Replication two than on Replication one while grade four subjects did better on Replication one than on Replication two. The grade by treatment interaction was significant. Although experimental subjects in all grades scored higher than control subjects, the experimental subjects in grades five and six had higher mean scores on Logic than the experimental subjects in grade four. The R x G x T interaction was due to the effect of treatment and grade differences across replications.

There was no difference between replications or treatments on General scores. However, subjects in grade six did better than those in grade five who, in turn, did better than those in grade four. The replication by grade interaction was due to the fact that grade five subjects in Replication two scored higher than those in Replication one while in grades four and six subjects in Replication one scored higher than those in Replication two. The significant replication by grade by treatment interaction was due to the effect of the replication by grade interaction across treatments.

On the Literature scores, there was no difference between replications or treatments. Although there was no difference between the scores of subjects in grades five and six, both groups did better than subjects in grade four. No significant interactions occurred in Literature for grades four, five, and six.

On the criterion measure of General Reading Total, there were no significant differences between replications, grade or treatment. The replication by grade interaction is due to the fact that subjects in grades four and six did better in Replication one than in Replication two while the subjects in grade five did better in Replication two than Replication one. The replication by treatment interaction was significant because subjects in the experimental group did better on Replication one than Replication two while subjects in the control group did better on Replication two than Replication one.

<u>Summary of the Comparison Across Grades</u>. The technique of analysis of covariance was used to compare the criterion scores of subjects at

different grade levels. The comparisons were limited to those instances where subjects had taken the same form of each test. ANCOVA tests between subjects in grades one and two were made only on the General Reading Test Total scores. Subjects in grade two scored significantly higher on general reading than those in grade one.

Scores of second and third graders on the criterion measures of critical reading ability were compared. There were no significant differences between the scores of second and third graders on the Critical Reading Test Total, or on the General and Literature sections. Only on the Logic section did subjects in grade three score higher than those in grade two.

Finally, comparisons were made of the scores of fourth, fifth, and sixth graders on all criterion measures. There were no grade differences on the test of general reading ability. On the Logic and Literature sections of the critical reading test, there was no difference between the scores of fifth and sixth graders, but each of these groups scored higher than the fourth graders. On the General section of the critical reading test, sixth graders performed better than fifth graders, who, in turn, did better than the fourth graders. There was no difference between the Critical Reading Test Total scores of fifth and sixth graders but each of these groups had higher total scores than the fourth graders.

Factors Related to Critical Reading Ability

A second major purpose of the study was to determine the relationship between elementary school children's ability to read critically and certain other factors including general reading ability, intelligence, personality, sex, and selected combinations of these factors. This section deals with these relationships and includes the following: single and multiple correlations at each grade level and a summary of these correlations across grades, a comparison of the correlations of the groups before and after treatment, and analysis of covariance data on selected variables.

Correlations

Pearson product-moment correlations were computed for the combined experimental and control groups at each grade level. The independent variables included Nonverbal Intelligence, Verbal Intelligence, General Reading Total, the sub-tests of Vocabulary and Comprehension on the general reading test, Personality Total and the subscores of Personal and Social Adjustment on the personality test. Correlations were computed on each of these independent variables with the criterion measures of

Critical Reading Total, as well as the Logic, General, and Literature sections of the critical reading test. Pretest scores were used to compute these correlations so that the data would not be affected by the experimental treatment. Tables presenting the correlations at each grade level are given in this section. The intercorrelations of all independent and dependent variables are presented in Appendix F. The instruments used to measure general reading, intelligence, personality, and critical reading, and the circumstances under which they were measured, are described in Chapter III of this report. The descriptive statistics for the instruments are also presented in that chapter.

Multiple correlations were also computed in order to answer the question concerning the strength of the relationship between critical reading ability and various combinations of selected independent variables. The computer program used was the MR-90 Multiple Regression program. Table 31 presents the pertinent data from the equations for each grade level. In order to show the relative importance of the factors in the multiple correlations, the partial regression coefficients (b) of each factor are also included. The partial coefficients indicate relationships freed from the concomitant influences of the other predictor. However, it is important to remember that the coefficients are obtained in the context of certain combinations of variables and also that the test scores do not represent their factors exactly.

The computer program yielded t-test data for the partial regression coefficients and F-test data for the multiple correlations. The significance of both the t's and F's was determined and these data are presented in Table 31. Shrunken R's are presented in the table as supplementary information.

Although several multiple correlations were run on different combinations of the total and sub-test scores of each variable, only the most representative R's are presented in this report. Since both general reading and intelligence were rather highly related to critical reading in most of the grades, it was of interest to determine their combined effect using Critical Reading Total as the criterion measure. Although the correlations between Personal Adjustment and Critical Reading Total were low, they did reach significance in three grades. Therefore, the project staff was interested in determining if this variable in combination with the others would add anything to the correlation.

Grade One. Table 24 presents the correlation matrix for all variables for grade one using as the dependent variables the total and sub-test scores from the fall administration of the critical reading test. With an N of 100 all correlations above .254 are significantly different from zero at the .01 level.

TABLE 24

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade One, N = 100)

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.310*	.220	.385*	.434*
Vocabulary	.222	.280*	.318*	.371*
Comprehension	.424*	.360*	.307*	.460*
General Reading Total	.273*	.300*	.337*	.411*
Personal Adjustment	.262*	.060	.176	.212
Social Adjustment	.330*	.120	.208	.287*
Personality Total	.342*	.150	.173	.284*

*Significant at the .01 level

The highest correlations of the independent variables with the criterion measure of Critical Reading Total were the total scores on the California Achievement Test in Reading, the Comprehension scores on that reading test, and the Nonverbal Intelligence scores; however, these correlations were only moderately high, accounting for 17-21 per cent of the variance. The lowest correlations with the criterion measure of Critical Reading Total were the Personality scores with the Personal Adjustment score not reaching the determined level of significance.

When the sections of the critical reading test were used as the criterion measures, it was found that all of the correlations of the independent variables with the Logic section were low with the exception of Comprehension (.424). The only independent variable not correlating significantly with this section was Vocabulary. Using the General and Literature sections of the critical reading test as the criterion measures, it was found that their correlation with the Personality scores were not significant. All of the other correlations were significant with the exception of Nonverbal Intelligence with scores on the General section; however, the correlations were low.

Multiple Correlations. In the zero-order correlations, Nonverbal Intelligence accounted for 19 per cent of the variance in the Critical Reading Total score while General Reading Total accounted for 17 per cent. When these two variables were combined, the correlation with Critical Reading Total was .49, accounting for 24 per cent of the variance. Therefore, these two variables in combination have a significantly higher correlation with Critical Reading Total than does either one separately. When Personal Adjustment was combined with General Reading Total it did not contribute significantly to the correlation; however, it did contribute significantly when combined with Nonverbal Intelligence. The multiple correlations for these combinations of variables for all grades are presented in Table 31. Only at the first-grade level did Social Adjustment contribute significantly to the multiple correlation when combined with General Reading Total and Personal Adjustment. The R from this multiple correlation was .483.

Grade Two. Table 25 presents the correlations of all the independent variables with the criterion measures for grade two using the total and sub-test scores from the fall administration of the critical reading test as the dependent variables. Since the N for grade two was 110, all correlations above .254 are significantly different from zero at the .01 level.

TABLE 25

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Two, N = 110)

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.271*	.371*	.210	.319*
Vocabulary	.251	.150	.339*	.355*
Comprehension	.276*	.290*	.307*	.402*
General Reading Total	.270*	.270*	.333*	.406*
Personal Adjustment	.103	-.040	.081	.074
Social Adjustment	.127	-.110	-.057	-.007
Personality Total	.129	-.080	.019	.042

*Significant at the .01 level

The Nonverbal Intelligence scores and the Reading scores correlate significantly with the total of the critical reading test; however, even the variables correlating moderately high (.402 Comprehension and .406 General Reading Total) account for only 16 per cent of the variance in the Critical Reading scores. Most of the correlations of the independent variables of Intelligence and Reading with the Logic, General and Literature sections of the critical reading test were significant but low. However, three of these correlations (Vocabulary with the Logic and General sections and Nonverbal Intelligence with the Literature section) did not reach the established level of significance. None of the Personality scores correlated significantly with the Critical Reading Total or any of the sections of the test.

Multiple Correlations. The independent variable correlating the highest with the criterion measure of Critical Reading Total in grade two was General Reading Total (.406). When Nonverbal Intelligence was combined with General Reading Total, the multiple correlation was not significantly different from zero. Multiple correlations were also computed using combinations of Personal Adjustment and General Reading with the Critical Reading Total and Personal Adjustment and Nonverbal Intelligence with the Critical Reading Total. Although both of the R's were significant, in neither case did Personal Adjustment add anything to the correlation.

Grade Three. In grade three, the correlations of the General Reading and Verbal Intelligence Test scores with Critical Reading Total were high (see Table 26). These variables accounted for 57 to 63 per cent of the variance in the Critical Reading Total scores. The correlation between Nonverbal Intelligence and Critical Reading Total was also high (.70). A similar pattern was obtained in the correlations of Reading and Intelligence with the Logic, General and Literature sections of the critical reading test. All of the correlations were moderately high to high with the Nonverbal Intelligence scores correlating slightly lower than the other scores.

Again, the most striking difference was found in the correlation of the Personality scores with Critical Reading Total and the Logic, General and Literature sub-tests. Only the Personal Adjustment scores correlated significantly with all of the Critical Reading scores, and these correlations were quite low.

Multiple Correlations. In the third grade, General Reading Total was the independent variable correlating the highest (63 per cent of the variance) with Critical Reading Total. When Nonverbal Intelligence (47 per cent of the variance) was combined with General Reading Total, the correlation with Critical Reading Total was significantly different from zero and accounted for 67 per cent of the variance in Critical Reading. Both Nonverbal Intelligence and General Reading Total contributed significantly to the multiple correlation as shown in Table 31. When Personal Adjustment was combined with General Reading Total, it

made no significant contribution to the correlation. However, when Personal Adjustment was combined with Nonverbal Intelligence it contributed significantly, but the partial regression coefficient shows that it had a much lower weight than Nonverbal Intelligence.

TABLE 26

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Three, N = 112)

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.670*	.610*	.641*	.700*
Verbal	.738*	.660*	.749*	.792*
Vocabulary	.671*	.650*	.720*	.753*
Comprehension	.721*	.680*	.720*	.778*
General Reading Total	.723*	.690*	.745*	.794*
Personal Adjustment	.325*	.300*	.363*	.368*
Social Adjustment	.153	.130	.136	.154
Personality Total	.058	.260*	.217	.192

*Significant at the .01 level

Grade Four. Table 27 presents the correlations of the independent variables with the scores from the fall administration of the critical reading test for grade four. The General Reading scores were taken from the fall administration of the California Reading Test. All correlations above .254 are significantly different from zero at the .01 level.

Although the correlations of General Reading and Verbal Intelligence with the Critical Reading Total scores appear to be markedly lower than the correlation of the same variables in the third grade, this is no doubt caused by the lower reliability (.66) of the critical reading test at this grade level. However, the correlations of Verbal Intelligence and the Comprehension section of the general reading test correlated moderately high with the Critical Reading Test Total (.526-.560). Three

correlations, Nonverbal Intelligence, Personal Adjustment, and Personality Total with the Critical Reading Total, did not reach significance. On the sections of the critical reading test, it is striking that none of the correlations of the Logic section with any independent variable were significant at the .01 level. In contrast, the correlations on the General section followed approximately the same pattern as the Critical Reading Total scores, with the exception of Nonverbal Intelligence which was significant but low. Although all but three (Nonverbal Intelligence .079, Personal Adjustment .093, and Personality Total .002) of the correlations of the Literature section with the independent variables were significant, the correlations were low.

Multiple Correlations. General Reading Total again accounted for more of the variance in the Critical Reading Total than any other single variable (31 per cent). The zero-order correlation between Nonverbal Intelligence and Critical Reading Total, however, did not reach the established level of significance. Thus, it is not surprising that when Nonverbal Intelligence and General Reading Total were combined, using Critical Reading Total as the criterion measure, Nonverbal Intelligence did not add to the correlation. In the multiple correlations involving combinations of the independent variables of Personal Adjustment and Nonverbal Intelligence and Personal Adjustment and General Reading Total, Personal Adjustment did not add significantly to either correlation.

TABLE 27

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Four, N = 118)

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.099	.255*	.079	.240
Verbal	.209	.501*	.269*	.526*
Vocabulary	.177	.445*	.286*	.497*
Comprehension	.113	.521*	.363*	.542*
General Reading Total	.151	.523*	.353*	.560*
Personal Adjustment	-.009	.161	.093	.148
Social Adjustment	.073	.390*	.350*	.341*
Personality Total	.088	.117	.002	.126

*Significant at the .01 level

Grade Five. Table 28 presents the correlations of the independent with the dependent variables for grade five. The N for all variables except the Personality variables was 116. Since one group in the sample was not allowed to take the personality test, any data involving Personality scores is based on a sample of 89. When the N is equal to 116, correlations above .254 are significantly different from zero at the .01 level. For Personality data when the N is equal to 89, correlations above .268 are significant at the .01 level.

TABLE 28

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Five, N = 116)[1]

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.300*	.363*	.304*	.439*
Verbal	.335*	.545*	.471*	.565*
Vocabulary	.253	.524*	.413*	.500*
Comprehension	.362*	.647*	.579*	.679*
General Reading Total	.341*	.643*	.549*	.651*
Personal Adjustment	.436*	.273*	.328*	.430*
Social Adjustment	.131	.189	.260	.255
Personality Total	.320*	.258	.328*	.384*

*Significant at the .01 level

[1]N = 89 on the correlations with Personality

Again Comprehension and General Reading Total correlated more highly with the criterion total than any of the other independent variables. Verbal I.Q., Vocabulary, and Nonverbal Intelligence followed in descending order in the level of correlation with this criterion. Personal Adjustment and Personality Total correlated significantly with the criterion total, but Social Adjustment did not reach the required level of significance. Correlations of the independent variables with the Logic sub-test of the criterion instrument were significant, but low,

with the exception of Vocabulary and Social Adjustment, both of which did not reach the established level of significance. Comprehension and General Reading Total correlated the highest with the General section of the criterion instrument. Moderately high correlations (.524-.545) were also obtained between the General section scores and Vocabulary and Verbal intelligence scores. Neither the scores on the Personality Total nor the Social Adjustment scores correlated significantly with the scores on the General section of the criterion instrument. The correlations obtained using the Literature section of the test as the criterion measure were similar to the correlations for the other scores on the criterion instrument.

Multiple Correlations. When the scores of the fifth graders on Nonverbal Intelligence and General Reading Total were combined, Nonverbal Intelligence again did not add anything to the multiple correlation (see Table 31). The zero-order correlations of Personal Adjustment and Nonverbal Intelligence with Critical Reading Total were both moderately high. Nonverbal Intelligence accounted for 19 per cent of the variance while Personal Adjustment accounted for approximately 19 per cent. When these two variables were combined, both added significantly to the correlation. The R for General Reading Total and Personal Adjustment combined, was .694 with both variables adding significantly to the correlation.

Grade Six. The correlations for grade six on the independent and dependent variables are presented in Table 29. The N for all data collected was 98 except for the Personality scores. Since one sixth grade group did not take the personality test, any data involving Personality scores are based on an N of 69. With an N of 98, correlations of .267 and above are significant at the .01 level and with an N of 69, correlations are significant above .303.

Each of the independent variables correlated significantly with the Critical Reading Total. The highest correlations with this criterion were General Reading Total, Verbal Intelligence and the Comprehension section of the general reading test. Moderately high correlations were also obtained between this criterion and Nonverbal Intelligence as well as the Vocabulary sub-test of general reading. The lowest correlation was with the Social Adjustment sub-test of personality.

Using the sections of the critical reading test as the criterion measures, moderately high correlations were obtained with most of the General Reading scores and with Intelligence. Only in one instance, Nonverbal Intelligence and the Literature scores, was there a low correlation. However, the correlations of the Logic and Literature sections of the critical reading test with Personality were low or not significant. Only in the case of the scores on the General section of the critical reading test were there moderately high correlations with Personality.

Multiple Correlations. At the sixth grade level, General Reading Total again correlated higher with the Critical Reading Total than any of the other single factors. Table 31 shows that the correlation was .751. When Nonverbal Intelligence was added to the correlation, a multiple R of .752 was obtained. Thus, Nonverbal Intelligence did not add significantly to the correlation. The multiple R of Nonverbal Intelligence and Personal Adjustment combined is .627 which means that these two combined account for 39 per cent of the variance in the Critical Reading Total, eliminating from double consideration elements that they have in common. Both factors contributed significantly to the correlation. However, Personal Adjustment did not add significantly to the multiple correlation involving General Reading Total as can be seen in Table 31.

TABLE 29

CORRELATIONS OF THE INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Six, N = 98)[1]

	CRITICAL READING			
	Logic	General	Literature	Total
Nonverbal	.520*	.553*	.373*	.602*
Verbal	.624*	.666*	.523*	.745*
Vocabulary	.502*	.599*	.524*	.675*
Comprehension	.629*	.666*	.487*	.735*
General Reading Total	.607*	.674*	.534*	.751*
Personal Adjustment	.324*	.534*	.270	.459*
Social Adjustment	.267	.440*	.160	.328*
Personality Total	.321*	.524*	.230	.425*

*Significant at the .01 level

[1]N = 69 on the correlations with Personality

Summary of the Correlations Across Grades. The correlations between the independent variables and the criterion measures of critical reading ability (see Table 30) were higher, in general, in grades three

and six. This may be explained by the higher reliabilities of the critical reading test at those grade levels. In the fall for grade three, the reliability of The Ohio State University Critical Reading Test was .85 and in grade six the reliability was .81. The correlations in grade four were lower than those in grades five and six. The reliability (.66) of the critical reading test in the fourth grade should be taken into consideration in examining the correlations for that grade.

General Reading Total and Comprehension were the two variables correlating the highest with Critical Reading Total across the grades. Comprehension correlated the highest with Critical Reading Total in grade one, accounting for 21 per cent of the variance and grade five accounting for 46 per cent of the variance. In grades two, three, four, and six, General Reading Total correlated the highest of any variable with the Critical Reading Total. These correlations ranged from .406 to .794. The correlations of the Vocabulary scores with the Critical Reading Total scores were lower than those of Comprehension and General Reading Total with this criterion; however, these correlations were high in grade three and moderately high in grades four, five, and six.

As would have been expected, Verbal Intelligence correlated higher than Nonverbal Intelligence with the Critical Reading Total. Verbal Intelligence test scores were not available in grades one and two, but in the other four grades, the correlation of Verbal Intelligence and Critical Reading Total ranged from .526 in grade four to .792 in grade three. Thus, Verbal Intelligence accounts for approximately 28 to 63 per cent of the variance in the Critical Reading Total scores. The Nonverbal Intelligence scores correlated less highly than Verbal Intelligence with Critical Reading Total; however, all of the correlations are significant with the exception of the correlation for grade four. While Nonverbal Intelligence accounts for only 10 per cent of the variance in the Critical Reading Total scores in grade two, it accounts for 49 per cent of the variance in grade three.

Many of the correlations between Personality scores and Critical Reading Total were not significantly different from zero. These include Personal Adjustment in the first, second, and fourth grades; Social Adjustment in the second and third grades; and Personality Total in the second, third, and fourth grades. The remaining correlations involving Personality and Critical Reading Total were significantly different from zero but were generally the lowest of the correlations ranging from .255 to .459. Thus, the Personality scores accounted for only 6 to 21 per cent of the variance.

In general, the correlations using sub-test scores on the critical reading test as the criterion measures were lower than those using the Critical Reading Total score, but the same general pattern occurred. The General Reading and Intelligence scores were significantly related to the Logic, General and Literature sections of the critical reading test in most instances. A few exceptions were Vocabulary with Logic and

Nonverbal Intelligence with General in grade one; Vocabulary with Logic and General and Nonverbal Intelligence with Literature in grade two; all scores with Logic and Nonverbal Intelligence with Literature in grade four; and Vocabulary with Logic in grade five.

TABLE 30

CORRELATIONS ACROSS GRADES OF INDEPENDENT VARIABLES WITH CRITICAL READING TOTAL

	Critical Reading Total					
	Grades					
	1	2	3	4	5	6
Nonverbal I.Q.	.434*	.319*	.700*	.240	.439*	.602*
Vocabulary	.371*	.355*	.792*	.526*	.565*	.745*
Comprehension	.460*	.402*	.753*	.497*	.500*	.675*
General Reading Total	.411*	.406*	.778*	.542*	.679*	.735*
Personal Adjustment	.212*	.074	.794*	.560*	.651*	.751*
Social Adjustment	.287*	-.007	.368*	.148	.430*	.459*
Personality Total	.284*	.042	.154	.341*	.255*	.328*

*Significant at the .01 level

The correlation of the sections of the critical reading test with the Personality test were either not significant or were fairly low. The variable of Personal Adjustment correlated significantly with Logic in grade one; with Logic, General and Literature in grades three and five; and with Logic and General in grade six. Social Adjustment correlated significantly with Logic in grade one; with General in grades four and six; and with Literature in grades four and five. The variable of Personality Total correlated significantly with Logic in grades one, five, and six; with General in grades three, five, and six; and with Literature in grade five. However, even the significant correlations of the Personality scores account for only 6 to 29 per cent of the variance in the scores on the sections of the critical reading test.

Multiple correlations were computed to determine the combined effect of the variables on their relationship to critical reading (see Table 31).

TABLE 31

MULTIPLE CORRELATIONS OF INDEPENDENT VARIABLES WITH THE CRITERION OF CRITICAL READING TOTAL

	Grade 1				Grade 2				Grade 3				Grade 4				Grade 5				Grade 6			
	b[1]	t[2]	R	F	b	t	R	F	b	t	R	F	b	t	R	F	b	t	R	F	b	t	R	F
NV	.091	2.91**	.490	14.98**	.066	1.83	.436	.13	.116	3.69**	.819	111.69**	-.011	-.51	.560	26.40**	.032	.69	.653	42.02**	.037	.73	.752	61.90**
G.R. Tot.	.087	2.47*			.131	3.41**			.257	7.77**			.124	6.56**			.229	6.79**			.250	6.66**		
$\tilde{R}$			.470				.418				.816				.549				.644				.746	
NV	.129	4.79**	.477	14.31**	.118	3.40**	.320	6.11**	.267	9.08**	.713	56.34**	.056	2.48*	.268	4.44**	.153	2.88**	.507	14.86**	.211	4.46**	.627	21.39**
Pers. Adj.	.151	2.23*			.018	.26			.184	2.01*			.048	1.33			.212	3.36**			.242	3.55*		
$\tilde{R}$			.468				.293				.706				.236				.492				.617	
G.R. Tot.	.132	4.25**	.441	11.76**	.160	4.56**	.409	10.75**	.329	12.23**	.797	95.15**	.119	6.98**	.559	26.21**	.226	7.03**	.694	40.08**	.234	7.76**	.766	46.96**
Pers. Adj.	.122	1.76			.039	.58			.097	1.21			-.000	-.00			.161	3.08**			.111	1.84		
$\tilde{R}$			.422				.390				.793				.549				.687				.758	

*Significant at the .05 level
**Significant at the .01 level
[1]Partial regression coefficients
[2]Test of significance for the partial regression coefficients

Since the Critical Reading Total score had the highest correlation with the independent variables, it was chosen as the criterion measure of critical reading. Three independent variables were chosen: General Reading Total since it had been highly related to Critical Reading Total at most grade levels; Nonverbal Intelligence since it was fairly highly related to the criterion measure at most grade levels, but less highly related to the other independent variables than was Verbal Intelligence; and Personal Adjustment since it was significantly related to the Critical Reading Total at several grade levels.

When General Reading Total was combined with Nonverbal Intelligence, the correlations were generally significant; however, Nonverbal Intelligence in most instances did not add significantly to the multiple correlation. If two tests are substantial measures of the same factor, a linear restraint would be operating with the result that the test having the lower correlation with critical reading would tend to have a lower coefficient in each equation in which both appear. This is probably what happened with the multiple correlation involving General Reading Total and Nonverbal Intelligence since in all grades except the first, Nonverbal Intelligence had a lower correlation than General Reading Total with the Critical Reading Total.

When Personal Adjustment and General Reading Total are combined, Personal Adjustment does not add anything to the correlation except at the fifth-grade level. In contrast, Personal Adjustment does add to the multiple correlation when combined with Nonverbal Intelligence in grades one, three, five, and six.

The Effect of Instruction Upon the Correlations. In order to determine if instruction resulted in a change in the relationship between critical reading and the independent measures, the difference in the correlation coefficients for the fall scores of the experimental and control groups combined* and the correlations of the experimental group after instruction was tested for significance. These tests were accomplished by making a z transformation of the two coefficients and then testing the difference. The smaller size of the group in the spring made it necessary to have a much higher correlation coefficient in order to reach the established significance level. The test of the difference between the correlation coefficients was also affected by this smaller sample size.

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*The difference between the correlations of the fall scores for the experimental and control groups was also tested for significance. Differences that were significant could be attributed to one variable, Social Adjustment, in the third grade. Since there were no systematic differences between the two groups, the experimental and control groups at each grade level were combined to represent children who had not yet received instruction in critical reading.

Only in the fourth grade did differences occur. At that grade level, the variables that correlated lower in the fall and the z scores of the differences were as follows: Nonverbal Intelligence and Critical Reading Total, 1.97; Nonverbal Intelligence and Logic, 2.25; Vocabulary and Logic, 2.46; Comprehension and Critical Reading Total, 2.46; General Reading Total and Critical Reading Total, 2.19; and General Reading Total and Logic, 3.26. All of these z scores were significant at the .05 level with the exception of the one for General Reading Total and Logic which was significant at the .01 level. The lower correlations in the fall were possibly due to test difficulties.

The data show no differences at the other grade levels in the correlations of the independent with the dependent variables before and after instruction. Thus, in this study, instruction does not appear to change the relationship between Critical Reading and the variables of Intelligence, General Reading and Personality.

ANCOVA on Intelligence and Sex Differences

In order to determine further whether the factors of sex and intelligence influenced scores on the criterion measures, analysis of covariance tests were conducted on the data at each grade level. The design was a three factorial 2 X 3 X 2 design for analysis of covariance where the factors were respectively treatment (experimental, control), intelligence (high, middle, low), and sex (male, female). The covariate was the pretest score on the given criterion measure. The criterion measures of interest were the General Reading Test Total, the Critical Reading Test Total, and the scores on each of the sections of the critical reading test.

Tables 32 to 43 present the data and the F's from the analysis of covariance at each grade level. There were no significant differences between the sexes at any grade level on any of the tests except on the Logic section of the critical reading test for grade five. At that grade level, females scored higher than males on the Logic section.

Subjects were divided into high, middle, and low intelligence groups on the following bases: low = lowest I.Q. to 89; middle = 90 to 116; high = 117 to highest I.Q. In grades two and six there were no differences between the scores of the intelligence groups on the General Reading Total. In grades one, four, and five, high I.Q. students scored higher than middle I.Q. students and middle I.Q. subjects scored higher than low I.Q. subjects on the General Reading Total. In grade three the high I.Q. group performed better than the middle I.Q. group, but the middle I.Q. group performed the same as the low I.Q. group.

At every grade level on the Critical Reading Test Total and the Literature section of the critical reading test, the high I.Q. group scored higher than the middle I.Q. group and the middle I.Q. group

TABLE 32

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	50	50	57	43	12	43	45
CRITICAL READING TOTAL							
Pretest	12.98	13.38	13.11	13.26	9.67	12.25	15.00
Posttest	20.14	17.66	18.49	19.42	13.58	16.64	22.42
Gain	7.16	4.28	5.38	6.18	3.91	4.39	7.42
Logic Section							
Pretest	4.70	6.00	5.18	5.58	4.00	5.07	5.98
Posttest	8.64	6.56	7.70	7.47	5.42	6.72	9.02
Gain	3.94	.56	2.52	1.89	1.42	1.65	3.04
General Section							
Pretest	3.24	2.92	2.96	3.23	2.33	2.88	3.47
Posttest	3.84	4.50	3.86	4.58	3.08	3.86	4.76
Gain	.60	1.58	.90	1.35	.75	.98	1.29
Literature Section							
Pretest	5.04	4.46	4.96	4.47	3.34	4.30	5.56
Posttest	7.66	6.60	6.93	7.40	5.08	6.12	8.65
Gain	2.62	2.14	1.97	2.93	1.74	1.82	3.09
GENERAL READING TOTAL							
Pretest	52.10	39.14	42.02	50.40	32.25	41.93	52.78
Posttest	71.24	56.74	60.30	68.88	47.75	58.51	73.55
Gain	19.14	17.60	18.28	18.48	15.50	16.58	20.77

TABLE 33

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE ONE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	4.99**	13.10**	5.37**	1.45	2.86
Intelligence	6.69**	7.86**	2.52	7.07**	5.95**
Sex	.59	.35	2.59	2.41	.90
T x I	1.44	.57	1.38	1.85	2.19
T x S	.00	1.31	2.26	1.08	.00
I x S	.37	.28	2.26	.02	1.63
T x I x S	.42	.13	1.51	.67	10.08**

**Significant at .01 level

TABLE 34

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	50	50	57	43	12	43	45
CRITICAL READING TOTAL							
Pretest	16.75	15.41	16.16	15.83	14.75	15.15	17.92
Posttest	24.74	22.08	22.92	23.46	19.95	22.11	26.58
Gain	7.99	6.67	6.76	7.63	5.20	6.96	8.66
Logic Section							
Pretest	6.26	4.54	4.96	5.54	4.80	5.13	5.92
Posttest	9.36	7.30	7.86	8.37	6.75	8.02	9.08
Gain	3.10	2.76	2.90	2.83	1.95	2.89	3.16
General Section							
Pretest	4.81	4.79	4.80	4.80	4.70	4.44	5.39
Posttest	6.36	6.08	6.22	6.18	5.30	5.98	7.02
Gain	1.55	1.29	1.42	1.38	.60	1.54	1.63
Literature Section							
Pretest	5.68	6.08	6.40	5.50	5.25	5.68	6.61
Posttest	9.02	8.70	8.74	8.91	7.91	8.06	10.52
Gain	3.34	2.62	2.34	3.41	2.66	2.38	3.91
GENERAL READING TOTAL							
Pretest	67.98	67.03	65.88	69.73	62.80	65.57	74.44
Posttest	81.77	83.13	81.74	83.18	80.31	81.47	85.30
Gain	13.79	16.10	15.86	13.35	17.51	15.90	10.86

TABLE 35

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE TWO

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	1.39	8.14**	.00	.03	2.03
Intelligence	8.17**	6.97**	4.30**	7.09**	.14
Sex	.54	.93	.01	.71	.00
T x I	.14	.38	.43	3.32	2.47
T x S	1.22	.12	.04	3.53	2.36
I x S	.58	.62	.29	.59	.16
T x I x S	.54	.22	.44	.51	1.24

**Significant at .01 level

TABLE 36

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	59	53	66	46	33	29	50
CRITICAL READING TOTAL							
Pretest	21.37	18.32	19.65	20.27	12.31	18.07	26.04
Posttest	28.80	21.98	25.32	25.93	15.85	24.21	32.78
Gain	7.43	3.66	5.67	5.66	3.54	6.14	6.74
Logic Section							
Pretest	7.35	6.57	6.92	7.04	4.34	6.28	9.12
Posttest	11.10	7.99	9.53	9.70	6.61	9.24	11.82
Gain	3.75	1.42	2.61	2.66	2.27	2.96	2.70
General Section							
Pretest	5.96	5.04	5.41	5.67	3.73	5.00	7.00
Posttest	7.21	5.88	6.44	6.78	4.49	5.93	8.34
Gain	1.25	.84	1.03	1.11	.76	.93	1.34
Literature Section							
Pretest	8.06	6.71	7.29	7.61	4.24	6.72	9.92
Posttest	10.49	8.11	7.96	9.35	4.67	9.00	12.64
Gain	2.43	1.40	.67	1.74	.43	2.28	2.72
GENERAL READING TOTAL							
Pretest	72.58	55.34	62.83	66.70	44.33	62.83	78.60
Posttest	80.71	73.94	76.38	79.13	59.58	76.72	89.80
Gain	7.13	18.60	13.55	12.43	15.25	13.89	11.20

TABLE 37

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE THREE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	14.90**	34.31**	2.63	3.09	5.98*
Intelligence	9.85**	11.75**	7.57**	15.59**	9.23**
Sex	.01	.19	.27	.17	.24
T x I	.20	.45	1.14	.67	.61
T x S	.38	.67	.29	.01	.26
I x S	.22	.17	.16	.49	2.62
T x I x S	.09	.72	.02	.19	.60

*Significant at .05 level
**Significant at .01 level

TABLE 38

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	60	58	62	56	38	44	36
CRITICAL READING TOTAL							
Pretest	14.87	16.50	15.02	16.22	14.13	16.21	16.36
Posttest	17.88	17.22	16.95	18.23	14.16	18.02	20.61
Gain	3.01	.72	1.93	2.01	.03	1.81	4.25
Logic Section							
Pretest	5.82	5.92	5.58	5.13	5.39	5.80	6.70
Posttest	7.64	6.89	7.03	7.54	6.08	7.14	8.70
Gain	1.82	.97	1.45	2.41	.69	1.34	2.00
General Section							
Pretest	4.13	4.96	4.11	5.02	3.92	4.66	5.05
Posttest	4.74	4.76	4.75	4.89	3.55	4.96	5.75
Gain	.61	-.20	.64	-.13	-.37	.30	.70
Literature Section							
Pretest	4.92	5.62	5.05	5.52	4.82	5.80	5.11
Posttest	5.50	5.57	5.29	5.80	4.47	5.93	6.17
Gain	.58	-.05	.24	.28	-.35	.13	1.06
GENERAL READING TOTAL							
Pretest	44.73	56.78	47.69	53.93	40.03	52.71	59.36
Posttest	59.85	69.64	62.99	66.52	51.11	66.82	76.33
Gain	15.12	12.86	15.30	12.59	11.08	14.11	16.97

TABLE 39

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE FOUR

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	2.38	2.34	.12	.03	.08
Intelligence	12.30**	9.28**	8.26**	4.47**	6.04**
Sex	.60	1.62	.00	.75	.70
T x I	1.65	2.97	.32	.27	.36
T x S	1.51	2.17	.09	.45	.22
I x S	.12	.41	1.40	.84	.01
T x I x S	1.06	.70	1.28	1.75	.24

**Significant at .01 level

TABLE 40

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	60	56	61	55	10	49	57
CRITICAL READING TOTAL							
Pretest	20.33	23.34	20.72	22.76	16.00	19.29	24.75
Posttest	26.75	26.79	25.18	28.53	17.90	24.25	30.49
Gain	6.42	3.45	4.46	5.77	1.90	4.96	5.74
Logic Section							
Pretest	7.70	8.32	7.90	8.22	5.90	7.10	9.24
Posttest	11.69	9.25	9.69	11.42	7.70	9.69	11.70
Gain	3.99	.93	1.79	3.20	1.80	2.59	2.46
General Section							
Pretest	6.73	7.43	7.24	7.09	4.70	6.45	8.22
Posttest	7.33	8.59	7.71	8.20	4.90	7.10	9.20
Gain	.60	1.16	.47	1.11	.20	.65	.98
Literature Section							
Pretest	5.90	7.59	6.07	7.45	5.40	5.73	7.81
Posttest	7.73	8.95	7.79	8.91	5.30	7.45	9.60
Gain	1.83	1.36	1.72	1.46	-.10	1.72	1.79
GENERAL READING TOTAL							
Pretest	77.62	88.34	79.49	86.46	61.30	75.66	92.70
Posttest	88.28	94.91	88.92	94.33	68.20	86.04	100.24
Gain	10.66	6.57	9.43	7.87	6.90	10.38	7.54

TABLE 41

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE FIVE

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	10.86**	39.77**	.52	.07	.59
Intelligence	4.31**	2.54	6.65**	5.01**	6.51**
Sex	3.05	9.10**	1.71	.41	.58
T x I	1.15	1.88	.57	.75	.13
T x S	.01	.51	.92	.23	.02
I x S	.63	.95	.40	.05	2.25
T x I x S	2.88	3.51	.89	1.85	2.63

**Significant at .01 level

TABLE 42

UNADJUSTED MEANS ON THE GENERAL READING AND CRITICAL READING TESTS BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

	Treatment		Sex		Intelligence		
	T_1	T_2	M	F	Low	Mid.	High
N	55	43	44	54	21	47	30
CRITICAL READING TOTAL							
Pretest	22.55	24.23	21.37	24.87	17.95	22.24	28.70
Posttest	28.67	27.91	26.93	29.48	18.95	28.41	34.80
Gain	6.12	3.68	5.56	4.61	1.00	6.17	6.10
Logic Section							
Pretest	8.70	9.32	8.86	9.13	6.91	8.62	11.10
Posttest	11.99	10.52	11.18	11.44	8.00	11.17	13.90
Gain	3.29	1.20	2.32	2.31	1.09	2.55	2.80
General Section							
Pretest	7.10	7.44	6.57	7.84	5.14	7.26	8.77
Posttest	8.49	8.38	8.14	8.67	5.52	8.62	10.17
Gain	1.39	.94	1.57	.83	.38	1.36	1.40
Literature Section							
Pretest	6.75	7.47	5.93	8.07	5.90	6.58	8.80
Posttest	8.19	9.01	7.61	9.24	5.43	8.48	10.70
Gain	1.44	1.54	1.68	1.17	-.47	1.90	1.90
GENERAL READING TOTAL							
Pretest	86.18	86.19	80.88	90.41	61.19	86.94	102.33
Posttest	95.35	94.98	91.43	98.22	74.76	96.66	107.13
Gain	9.17	8.79	10.55	7.81	13.57	9.72	4.80

TABLE 43

F TESTS FROM ANALYSIS OF COVARIANCE FOR GRADE SIX

Source	CRITICAL READING Total	Logic	General	Literature	GENERAL READING Total
Treatment	1.50	4.60**	.10	2.25	.00
Intelligence	10.31**	8.21**	4.57**	13.26**	2.14
Sex	.00	.06	.55	1.72	.21
T x I	.03	.33	.78	1.32	1.54
T x S	.04	.01	.05	.09	.21
I x S	1.31	1.88	1.76	.65	.97
T x I x S	.11	.32	1.01	.14	.34

**Significant at .01 level

scored higher than the low I.Q. group. This pattern also occurred on the Logic section for all grades except grade five and on the General section for all grades except grade one. In the fifth grade there were no differences between the scores of the three intelligence groups on the Logic section and in the first grade no differences on the General section.

As seen in Tables 32 to 43 only one interaction occurred in all of the analyses. This was a three-way interaction of Treatment by Intelligence by Sex on the general reading test in grade one. The interaction of major importance in this analysis is that of Treatment by Intelligence. Nowhere is this interaction significant. This indicates that when Treatment effects were found, these effects existed across Intelligence levels.

Observations of Critical Reading Lessons

In order to investigate differences between the verbal behavior of the children's literature teachers (hereafter referred to as the control group) and the critical reading teachers (the experimental group) and the corresponding differences between pupils in the control and experimental groups, chi-square analyses were made in the usual manner for computing chi-square. The expected frequency for each cell was determined using the observed marginal totals and is presented in parentheses on all tables. The chi-square values for each row and column and the over-all chi-square values are presented also in the tables. The level of significance set for all data was .01. Cell chi-squares were used to assist in interpreting the data.

The data were first analyzed in terms of teachers' verbalizations, and secondly, according to pupils' responses. The second analysis included the data showing the relationship between teachers' questions and the level of pupil responses. In the analysis of teachers' behaviors, the eighth category (controlling) was dropped because the expected frequency for each cell was less than one.

Teacher Verbal Behavior

The teachers' verbalizations were first divided into statements and questions. Both the control group and the experimental group had a significantly higher frequency of questions than statements. In both groups the ratio of questions to statements was approximately four to one.

Significant differences were found between the control and experimental teachers in the kinds of statements they made. As shown

in Table 44, the control teachers made significantly more statements than did the experimental teachers that could be classified under gathering specific facts and the experimental teachers made significantly more analytical, summarizing and evaluating remarks than did the control teachers. The two groups differed, also, in the kinds of questions they asked (Table 45). Control teachers asked significantly more questions classified as specific facts, interpreting, and applying than did the experimental teachers; while the experimental teachers tended to ask more of the clarifying, analyzing, and evaluating types of questions. Because teachers' questions were more directly related to pupil responses than teachers' statements, only the teachers' questions were analyzed to answer the major questions pertaining to teachers' verbal behavior.

Grade Level Differences in Teacher Questions. Teachers' questions were compared across grade levels for the control and experimental groups separately. Significant differences were found in the questioning behavior of control teachers at grades two, four, five, and six. Inspection of Table 46 shows that (1) second-grade teachers asked significantly fewer specific fact questions than expected and a significantly greater number of clarifying and applying questions than expected, (2) fourth-grade teachers asked a significantly greater number of analytical questions than was expected, (3) fifth-grade teachers asked significantly more specific fact questions than expected and significantly fewer than expected of clarifying and analyzing questions, and (4) sixth-grade teachers asked significantly more than expected of specific fact questions and fewer than expected of applying questions.

Significant differences in the questioning behavior of the experimental teachers were found at grades one, two, and six. These differences, as shown in Table 47, were due to the higher than expected frequency of specific fact questions in grades one and two but lower than expected for grade six, and the higher than expected frequency of clarifying questions in grade two, and summarizing and evaluating questions in grade six. In general, grade level data revealed no consistent gradual increase in use of more thought demanding questions at higher grade levels.

Differences in Teacher Questions Over Time. In order to obtain data about changes in teachers' questions over time, two types of analyses were made. First, the questions for the two groups of teachers were compared for three time segments: fall, winter, and spring. Secondly, the questions for each group were analyzed separately, to detect changes that occurred within the group. Tables 48, 49, and 50 show that, for each time segment, the types of questions asked by control and experimental teachers differed significantly. In the fall (Table 48), control teachers appeared to have placed significantly greater emphasis on specific fact and interpreting questions as contrasted with experimental teachers who placed significantly greater emphasis on clarifying, analyzing, and applying questions.

TABLE 44

TEACHER STATEMENTS: CONTROL AND EXPERIMENTAL GROUPS BY STATEMENT TYPE

Group	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Control	(159) 208	(72) 69	(41) 51	(50) 30	(32) 28	(69) 49	(34) 23	458	36.17**[1]
Experi-mental	(190) 141	(87) 90	(48) 38	(60) 80	(39) 43	(83) 103	(41) 52	547	30.29**
Total	349	159	89	110	71	152	75	1005	
Chi-Square	27.68**[2]	.30	4.9	14.85**	1.07	10.89**	6.71**		66.46**[3]

**Significant at the .01 level
[1]df = 6
[2]df = 1
[3]df = 6

TABLE 45

TEACHER QUESTIONS: CONTROL AND EXPERIMENTAL GROUPS BY QUESTION TYPE

Group	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Control	(396) 500	(99) 73	(312) 447	(449) 238	(193) 246	(28) 18	(79) 34	1556	234.60**[1]
Experi-mental	(563) 460	(141) 167	(445) 310	(638) 849	(274) 222	(39) 49	(113) 158	2215	164.80**
Total	960	240	757	1087	468	67	192	3771	
Chi-Square	46.38**[2]	11.64**	98.81**	168.22**	24.66**	5.72	43.94**		399.41**[3]

**Significant at the .01 level

[1]df = 6

[2]df = 1

[3]df = 6

TABLE 46

TEACHER QUESTIONS FOR CONTROL GROUP, GRADE LEVEL BY QUESTION TYPE

Grade	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
1	(93) 91	(14) 14	(83) 96	(44) 42	(46) 38	(3) 2	(6) 6	289	4.04[1]
2	(82) 34	(12) 24	(73) 70	(39) 47	(40) 69	(3) 3	(6) 7	254	62.96**
3	(73) 72	(11) 8	(65) 57	(35) 35	(36) 47	(3) 2	(5) 5	226	5.31
4	(84) 73	(12) 13	(75) 69	(40) 58	(41) 32	(3) 8	(6) 8	261	21.33**
5	(83) 118	(12) 5	(74) 66	(39) 21	(41) 42	(3) 2	(6) 3	257	30.26**
6	(86) 112	(13) 9	(77) 89	(41) 35	(43) 18	(3) 1	(6) 5	269	27.00**
Total	500	73	447	238	246	18	34	1556	
Chi-Square	51.98**[2]	18.12**	6.20	19.45**	41.83**	10.65	2.66		150.92**[3]

**Significant at the .01 level

[1]df = 6

[2]df = 5

[3]df =30

TABLE 47

TEACHER QUESTIONS FOR EXPERIMENTAL GROUP, GRADE LEVEL BY QUESTION TYPE

Grade	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
1	(82) 117	(30) 16	(55) 53	(151) 147	(39) 30	(9) 5	(28) 26	394	25.65**[1]
2	(86) 136	(31) 52	(58) 58	(159) 119	(41) 27	(9) 6	(30) 16	414	65.22**
3	(56) 36	(21) 21	(38) 44	(104) 122	(27) 32	(6) 3	(19) 14	272	15.22
4	(55) 42	(20) 15	(37) 33	(102) 111	(27) 37	(6) 4	(19) 23	265	11.23
5	(92) 76	(33) 36	(62) 58	(169) 178	(44) 48	(10) 11	(31) 34	441	4.27
6	(89) 53	(32) 27	(60) 64	(164) 172	(43) 48	(9) 20	(31) 45	429	35.10**
Total	460	167	310	849	222	49	158	2215	
Chi-Square	72.01**[2]	22.52**	1.94	14.74	13.17	16.57**	15.73**		156.72**[3]

**Significant at the .01 level
[1]df = 6
[2]df = 5
[3]df = 30

TABLE 48

TEACHER QUESTIONS IN THE FALL: CONTROL AND EXPERIMENTAL GROUPS BY QUESTION TYPE

Group	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Control	(185) 249	(40) 16	(122) 185	(161) 88	(93) 75	(14) 10	(19) 11	634	109.62**[1]
Experi-mental	(211) 147	(46) 70	(140) 77	(183) 256	(107) 125	(16) 20	(21) 29	724	95.99**
Total	396	86	262	344	200	30	40	1358	
Chi-Square	41.72**[2]	27.25**	60.25**	61.56**	6.78**	2.15	5.92		205.61**[3]

**Significant at the .01 level
[1]df = 6
[2]df = 1
[3]df = 6

TABLE 49

TEACHER QUESTIONS IN THE WINTER: CONTROL AND EXPERIMENTAL GROUPS BY QUESTION TYPE

Group	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Control	(148) 177	(45) 38	(89) 133	(145) 70	(55) 83	(11) 5	(26) 13	519	91.27**[1]
Experi-mental	(213) 184	(64) 71	(128) 84	(210) 285	(80) 52	(15) 21	(38) 51	748	63.32**
Total	361	109	217	355q	135	26	64	1267	
Chi-Square	9.72**[2]	1.68	37.08**	66.25**	23.50**	5.08	11.29**	154.5	154.59**[3]

*Significant at the .01 level
[1]df = 6
[2]df = 1
[3]df = 6

TABLE 50

TEACHER QUESTIONS IN THE SPRING: CONTROL AND EXPERIMENTAL GROUPS BY QUESTION TYPE

Group	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Control	(71) 74	(16) 19	(98) 129	(136) 80	(47) 88	(4) 3	(31) 10	403	85.01**[1]
Experi-mental	(132) 129	(29) 26	(180) 149	(252) 308	(86) 45	(8) 9	(57) 78	744	46.04**
Total	203	45	278	388	133	12	88	1147	
Chi-Square	.15[2]	.99	15.48**	35.87**	56.19**	.54	21.81**		131.06**[3]

**Significant at the .01 level

[1]df = 6

[2]df = 1

[3]df = 6

During the winter, the control teachers asked significantly more interpreting and applying questions than did the experimental teachers while the experimental teachers asked significantly more analyzing questions than the control teachers. The gathering specific fact column also reached significance. This was due to the fact that the experimental group asked fewer than the expected number of questions while the control group asked more than expected. Significant differences were observed also between the experimental and control teachers in the spring. Control teachers asked significantly more interpreting and applying questions than did the experimental teachers and the experimental teachers asked a significantly greater number of analyzing and evaluating questions than did the control.

As shown in Table 51, significant changes over time occurred in the control teachers' use of three types of questions: specific fact, clarifying, and applying. Emphasis on specific fact questions decreased from fall to spring more than was expected but the use of applying questions increased. This latter trend is opposite to what is predicted by the expected frequencies. Table 52 indicates that significant differences for the experimental teachers were found in the specific fact, clarifying, interpreting, applying, and evaluating categories. From fall to spring experimental teachers had decreased their emphasis on applying questions and increased their use of the interpreting and evaluating types. A decrease in the number of questions asked in the categories of gathering specific facts and clarifying was noticed between winter and spring.

Pupil Responses

As stated earlier, pupil responses were tallied along a continuum which was divided into five categories representing levels of thought. Table 53 presents the total frequencies of responses at each level for both the control and experimental groups. Significant differences between the observed responses of both groups and the expected frequencies for each were found at all levels, except Level 1, random response. The control group made significantly more literal statements, (repeating material from reading sources, Level 2), and inferring and applying statements (Level 3), whereas the experimental group demonstrated the higher levels of thinking, including hypothesizing (Level 4) and evaluating (Level 5).

Level of Response by Question Type. The main purpose of the observation study was to ascertain the relationship between the teachers' questions and the level of responses given by pupils. When teachers' questions were compared to pupil responses for the control group (Table 54), significant differences between the observed and expected responses were found for all question types except that of clarifying. Specific fact questions produced significantly more than expected of random (Level 1) and literal responses (Level 2), while interpreting

TABLE 51

TEACHER QUESTION TYPE BY TIME VISITED FOR CONTROL GROUP

Time	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Fall	(204) 249	(30) 16	(182) 185	(97) 88	(100) 75	(7) 10	(14) 11	634	25.20**[1]
Winter	(167) 177	(24) 38	(149) 133	(79) 70	(82) 83	(6) 5	(11) 13	519	11.55
Spring	(130) 74	(19) 19	(116) 129	(62) 80	(64) 88	(5) 3	(9) 10	403	40.78**
Total	500	73	447	238	246	18	34	1556	
Chi-Square	34.47**[2]	14.00**	3.29	7.41	15.62**	1.73	.99		77.52**[3]

**Significant at the .01 level

[1]df = 6

[2]df = 2

[3]df = 12

TABLE 52

TEACHER QUESTION TYPE BY TIME VISITED FOR EXPERIMENTAL GROUP

Time	Gathering Specific Facts	Clari-fying	Inter-preting	Analyzing	Applying	Summa-rizing	Evalu-ating	Total	Chi-Square
Fall	(150) 147	(55) 70	(101) 77	(277) 256	(73) 125	(16) 20	(52) 29	724	60.60**[1]
Winter	(155) 184	(56) 71	(105) 84	(287) 285	(75) 52	(17) 21	(53) 51	748	21.32**
Spring	(154) 129	(56) 26	(104) 149	(285) 308	(75) 45	(17) 9	(53) 78	744	68.61**
Total	460	167	310	849	222	50	158	2216	
Chi-Square	9.58**[2]	24.29**	29.28**	3.51	56.68**	5.44	21.75**		150.53**[3]

**Significant at the .01 level

[1]df = 6

[2]df = 2

[3]df = 12

TABLE 53

LEVEL OF PUPIL RESPONSES TO TEACHER QUESTIONS BY CONTROL AND EXPERIMENTAL GROUPS

Group	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
Control	96 (109)	1180 (1031)	1649 (1479)	420 (472)	114 (370)	3459	225.57**[1]
Experimental	134 (122)	993 (1146)	1472 (1644)	577 (525)	667 (411)	3843	202.88**
Total	230	2173	3121	997	781	7302	
Chi-Square	2.66[2]	41.53**	37.20**	10.92**	336.13**		428.45**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 1

[3]df = 4

TABLE 54

LEVEL OF PUPIL RESPONSES BY QUESTION TYPE FOR CONTROL GROUP

Question Type	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
Gathering specific facts	47 (28)	728 (346)	207 (483)	27 (123)	4 (33)	1013	694.34**[1]
Clarifying	3 (4)	58 (46)	65 (64)	6 (16)	3 (4)	135	10.31
Interpreting	28 (28)	150 (338)	621 (473)	168 (120)	25 (33)	992	171.86**
Analyzing	4 (15)	130 (185)	270 (259)	118 (66)	21 (18)	543	66.74**
Applying	9 (18)	92 (225)	450 (315)	83 (80)	26 (22)	660	142.65**
Summarizing	3 (1)	15 (14)	8 (20)	15 (5)	0 (1)	41	31.47**
Evaluating	2 (2)	7 (26)	28 (36)	3 (9)	35 (2)	75	447.34**
Total	96	1180	1649	420	114	3459	
Chi-Square	28.76**[2]	639.99**	271.24**	165.78**	458.93**		1564.71**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 6

[3]df = 24

questions generated higher levels of thinking which include inferring (Level 3), and hypothesizing (Level 4). Analyzing questions elicited significantly more than expected of hypothesizing responses (Level 4). Applying questions brought more inferring responses (Level 3), while summarizing questions elicited more hypothesizing responses (Level 4). The evaluative questions, though few in number, brought higher frequencies of evaluating responses (Level 5).

In the experimental group (Table 55) significant differences were found for all types of questions except that of summarizing, which was the least used category. As with the control group, specific fact questions resulted in significantly more random (Level 1) and literal responses (Level 2) and fewer responses at the highest three levels. Clarifying questions caused pupils to respond more frequently at Levels 2 and 3, and less frequently at Levels 4 and 5. Interpreting questions elicited more Levels 3 and 4 responses; analyzing questions, however, prompted, not only more Levels 3 and 4 responses, but also more at Level 5. Applying questions brought significantly more Level 3 responses and fewer at Level 2. The evaluative questions stimulated higher frequencies of pupil responses at Levels 4 and 5. Data for both the control and experimental groups show that interpretive, analytical, and evaluative questions are the most effective ones in eliciting the higher levels of responses from pupils.

Grade Level Differences in Pupil Responses. Differences in levels of responses that occurred between grade levels are shown in Tables 56 and 57 for the control and experimental groups. In the control group differences in responses were found between grades one, two, three, and four; however, inspection of Table 56 shows that these differences were due only to the pupils' responses at Levels 1 (random response) and 4 (hypothesizing). Apparently, pupils in grade two gave more than the expected number of Level 4 responses while pupils in grades one and three made fewer responses than expected at this level and more responses than expected at Level 1. Fourth-grade differences can be accounted for only by the fact that those pupils gave fewer than the expected number of random responses.

Responses of experimental pupils (Table 57) show significant differences between all grade levels and in the utilization of all five levels of response. Under the category of random responses the only significant difference was for grade five where fewer responses than expected were obtained. In the literal memory category more responses than expected were elicited from pupils in grades one and two and fewer than expected in grades three, four, and six. In the category of inferring the children in grade two made fewer responses than expected and in the hypothesizing category the children in grade three made more than expected while grade five made fewer than expected. In the last category, evaluating, subjects in grade three made significantly fewer responses than expected.

TABLE 55

LEVEL OF PUPIL RESPONSES BY QUESTION TYPE FOR EXPERIMENTAL GROUP

Question Type	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
Gathering specific facts	36 (23)	463 (174)	138 (257)	22 (101)	13 (117)	672	698.11**[1]
Clarifying	9 (8)	89 (61)	117 (91)	15 (36)	7 (41)	237	60.46**
Interpreting	22 (20)	111 (147)	284 (218)	102 (85)	50 (99)	569	56.37**
Analyzing	38 (55)	215 (406)	665 (601)	281 (236)	371 (272)	1570	145.78**
Applying	10 (13)	51 (98)	195 (145)	70 (57)	52 (66)	378	46.40**
Summarizing	3 (3)	27 (23)	22 (34)	19 (14)	19 (16)	90	8.08
Evaluating	16 (11)	37 (84)	51 (125)	68 (49)	155 (57)	327	249.91**
Total	134	993	1472	577	667	3843	
Chi-Square	14.79[2]	642.84**	155.66**	98.11**	353.71**		1265.10**[3]

**Significant at the .01 level
[1]df = 4
[2]df = 6
[3]df = 24

TABLE 56

LEVEL OF PUPIL RESPONSES BY GRADE FOR CONTROL GROUP

Grade	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
1	25 (15)	190 (179)	247 (251)	40 (64)	24 (17)	523	19.57**[1]
2	8 (14)	148 (172)	242 (240)	94 (61)	11 (17)	503	25.43**
3	25 (13)	164 (164)	240 (229)	37 (58)	14 (16)	480	18.76**
4	6 (23)	291 (280)	398 (392)	105 (100)	22 (27)	822	14.11**
5	19 (15)	167 (178)	246 (249)	75 (64)	16 (17)	523	4.33
6	13 (17)	220 (206)	276 (288)	69 (73)	27 (20)	605	5.06
Total	96	1180	1649	420	114	3459	
Chi-Square	34.83**[2]	5.89	1.30	37.06**	8.19		87.27**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 5

[3]df = 20

TABLE 57

LEVEL OF PUPIL RESPONSES BY GRADE FOR EXPERIMENTAL GROUP

Grade	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
1	30 (22)	200 (164)	208 (244)	91 (95)	106 (110)	635	16.33**[1]
2	26 (19)	215 (142)	168 (211)	63 (82)	78 (96)	550	56.75**
3	20 (20)	107 (147)	256 (218)	131 (85)	55 (99)	569	61.30**
4	22 (20)	106 (150)	248 (222)	88 (87)	120 (101)	584	21.85**
5	8 (25)	212 (185)	283 (275)	70 (107)	143 (125)	716	31.63**
6	28 (27)	153 (203)	309 (301)	134 (118)	165 (137)	789	19.90**
Total	134	993	1472	577	667	3843	
Chi-Square	16.88**[2]	87.91**	23.80**	43.97**	35.20**		207.77**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 5

[3]df = 20

Changes in Pupil Responses Over Time. To discover changes in pupils' production of critical responses over the time of the experimental period, the observational data were organized into fall, winter, and spring sequences for the control and experimental groups separately. Tables 58 and 59 show the total observed and expected frequencies of responses for each of the three time segments. The responses of the control group indicated a trend of decreasing frequency of random (Level 1) and literal responses (Level 2) from fall to spring. The utilization of the higher categories of thinking--Levels 4 and 5--increased from fall to spring, significantly contributing to the changes in pupil behavior.

Differences in experimental pupils' responses, as shown in Table 59, are significant only for the spring observations. These differences are attributable to the fact that for Level 3 the number of responses were fewer than expected and for Level 5 the number of responses were greater than expected. Although responses in both Levels 4 and 5 show gradual increases from fall through winter to spring, differences were not significant, except at Level 5 in the spring. No changes occurred in the Level 2 (literal) responses over the time of the study. This continued use of literal responses may have been due to the fact that new substantive materials, requiring considerable literal understanding, were introduced to the experimental group throughout the winter and spring segments of the study.

Summary of the Observation Data

The observation data revealed distinguishing characteristics of teachers' verbal behavior. Both the control and experimental teachers had a significantly higher frequency of questions than statements.

There were differences between the experimental and control teachers in the types of questions they asked. Control teachers emphasized questions classified as specific facts, interpreting, and applying while the experimental teachers asked more clarifying, analyzing, and evaluating types of questions. The analysis of the teachers' questions across grade levels revealed no consistent increase from grades one through six in the use of more thought-demanding questions in either treatment group. However, the experimental teachers in grades one and two asked more specific fact questions than expected while those in grade six asked more evaluative questions than were expected.

Significant changes occurred in the teachers' questions from fall to spring. The control teachers decreased their use of questions asking for specific facts and increased their use of applying questions. On the other hand, the experimental teachers decreased their emphasis on applying questions and increased their use of the interpreting and evaluating types of question from fall to spring. It was also observed that experimental teachers asked fewer questions in the categories of gathering specific facts and clarifying in the spring than in the winter.

TABLE 58

LEVEL OF PUPIL RESPONSES BY TIME FOR CONTROL GROUP

Time	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
Fall	52 (33)	605 (401)	437 (560)	68 (143)	12 (39)	1174	200.29**[1]
Winter	28 (33)	353 (408)	650 (570)	133 (145)	32 (39)	1196	21.83**
Spring	16 (30)	222 (372)	562 (519)	219 (132)	70 (36)	1089	159.75**
Total	96	1180	1649	420	114	3459	
Chi-Square	19.08**[2]	172.00**	41.60**	96.96**	52.23**		381.87**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 2

[3]df = 8

TABLE 59

LEVEL OF PUPIL RESPONSES BY TIME FOR EXPERIMENTAL GROUP

Time	Level of Response 1 Guessing Random	2 Literal Memory	3 Inferring Applying Illustrating	4 Theorizing Hypothesizing	5 Evaluating Criteria	Total	Chi-Square
Fall	35 (41)	315 (301)	481 (446)	170 (175)	163 (202)	1164	11.88[1]
Winter	58 (45)	327 (331)	529 (491)	177 (192)	190 (222)	1281	12.95
Spring	41 (49)	351 (361)	462 (535)	230 (210)	314 (242)	1398	34.52**
Total	134	993	1472	577	667	3843	
Chi-Square	5.98[2]	1.01	15.85**	3.28	33.23**		59.35**[3]

**Significant at the .01 level

[1]df = 4

[2]df = 2

[3]df = 8

There was a relationship between the kinds of questions teachers asked and the level of critical responses given by the pupils. Specific fact questions elicited lower level responses whereas interpreting, analyzing, and evaluating questions brought higher levels of response.

The pupils changed the level of their responses over the time of the study. Although subjects in the control group increased their use of the higher levels of thinking across the year, this was due to the fact that they made so few of these responses in the fall. Experimental pupils, on the other hand, made a consistently large number of higher level responses and this ceiling effect may have inhibited significant increases. In the spring, the number of evaluating responses made by the experimental group increased and the number of applying responses decreased.

Problems and Reactions of the Teachers

The experimental teachers in the Critical Reading Project were asked to keep a record of the problems they encountered and the reactions they had during the experimental phase of the study. Data were collected from records kept by these teachers during the year and from interviews with them at the end of the experimental period. Their problems and reactions were grouped into the following four categories: procedures, lesson content, attitudes, and pupil learning.

Procedures

Time appeared to be a problem throughout the study. Teaching critical reading skills, such as comparing sources, checking the author's competence, or analyzing components of writing, are time-consuming activities. In many instances, teachers had to include critical reading in an extensive reading program that had to be maintained.

Because the development of the experimental materials was in progress during the greater portion of the experimental phase, teachers received the separate units at different times throughout the year. Some teachers considered this disadvantageous. The interviews revealed that these teachers would have preferred receiving all of the teaching units at the beginning of the study. They believed that a more balanced and integrated instructional program would have resulted from their being able to instruct from the several units simultaneously. Some of the teachers reported that they did not have time to develop fully the last two units which focused on components of literature and literary devices.

A second procedural problem was related to the availability

of materials for instruction. When the lessons were centered around a specific selection from children's literature, teachers often did not have available more than one copy of a book. When this happened, the extensive oral reading that was needed to share the content with the class or a group of pupils was an extremely time consuming task.

The lack of adequate materials for instruction occurred more frequently in the analysis of informational materials than it did in the analysis of literary materials. Informational and argumentative materials are usually written for children older than the subjects of this study. Accordingly, it was difficult for teachers to find books for the pupils to read that required the application of the established criteria.

Stimulating children's interest in the analysis of informational materials was also a problem for several teachers. Materials that were written about incidents from the children's own lives seemed to be more successful than items taken from other sources. Several teachers in the primary grades reported that newspaper articles were too difficult for use in their classrooms unless they rewrote them. They found advertisements and TV commercials useful in teaching concepts in semantics and logic. For example, one child brought in an ad which said that there was a new engineering feat by Westinghouse which keeps repair bills down. The child said, "How do we know that the cost of paying for the engineering feat is less than the repair bills?"

Many of the teachers asked for more materials that were below their pupils' reading level since they found it easier to teach the concepts of critical reading from materials that the children could read without effort. On the other hand, a third-grade teacher, whose students were very capable, said that many of the materials were not difficult enough for her children.

Several teachers reported that they thought it was helpful to use good examples of advertisements and other materials as well as examples of those containing fallacies. Some teachers reported that when they continually illustrated points with misleading advertisements, their students thought all advertising was unreliable.

Content

Teachers' reactions and problems that were classified as content-related centered about the "newness" of the content and skills, the difficulty of the materials, the inadequate background or "readiness" of the pupils, and the vocabulary of specialized terms. Some teachers reported that they had to study the concepts of the instructional materials themselves, before presenting lessons to the pupils. The following statement from one teacher illustrates this:

> I lacked background in elementary logic, myself. I feel certain that I could do a better job of teaching it another time.

Teachers generally stated, however, that the "Background for the Teacher" materials were most helpful in providing much needed information.

Some of the problems teachers identified were related to teaching specific critical reading skills. The following logic skills were cited by a few teachers as being difficult to teach: (1) finding false and hidden premises, (2) determining valid and invalid statements, (3) identifying false analogies, and (4) constructing syllogisms. One teacher stated that her pupils could grasp the syllogism in the special critical reading lessons, but could not transfer the ability to other reading materials. Perhaps the most difficult skill, for pupils at all grade levels, involved recognizing that a statement could be valid even though the premise was false.

In the group of authenticity skills, three teachers mentioned that information about authors was extremely hard to locate; one teacher reported difficulty with helping children develop criteria for judging the qualifications of the author; and another stated that teaching children to compare and contrast materials was not easy. Many teachers mentioned, however, that the comparison of several controversial reports on the same topic enabled the pupils to realize that all books are not correct.

Several skills pertaining to the analysis and evaluation of literature were mentioned at least once as being difficult to teach. They were interpreting figurative language, recognizing plot structure, distinguishing between plot and theme, recognizing climax, and reading beyond the literal level. One primary grade teacher noted that characterization was a difficult component for young children. She explained it as follows:

> Literature for children at this age has rather poorly developed characterization. The need for brevity does not allow the author enough space to fully develop a character. Vocabulary places further limits on character development.

Primary teachers said that occasionally reading materials chosen to present critical reading skills were too difficult or inappropriate in content for their pupils. At least two persons reported that they had to rewrite materials in the language of the children with whom they were working. Although the project staff attempted to restrict the vocabulary of the lesson plans to a level appropriate for each grade, obviously they were not successful in all cases.

The specialized vocabulary of logic and literary terms was viewed as difficult. As one teacher stated, "How do you explain a generalization to a first grader?" Another mentioned that the children could

detect when forms of writing were different, but could not always identify them as biography, fable, fairy tale, and so on. Generally, teachers reported that children understood the idea intended in a lesson, but were not able to attach the appropriate label to a logical fallacy or literary device. Other teachers recognized the fact that their students had an inadequate experiential and educational background for this kind of instruction. One fifth grade teacher said:

> There is too much to teach in just one year. We need a school in which children are taught to read this way from the very beginning. We had to teach them the skills that were appropriate at our grade level plus all of the ones that should have been mastered in the preceding years.

Attitudes

Teachers recognized a change in their pupils, but stated that they thought the changes were not the kind that could be objectively measured with paper and pencil tests. One teacher said that she saw growth in critical reading more in the changing attitudes of the children than in their written responses to questions. This attitude was described as a questioning one which was not restricted to reading materials, but extended to many kinds of communication. Two teachers voiced concern about how teachers in subsequent grade levels would react to this curious, skeptical attitude.

Another teacher reported a different kind of change in attitude. He said students' respect for the ideas of another person grew throughout the school year. To illustrate, this sixth-grade teacher stated that his children tended to argue emotionally and bicker over minor points at the beginning of the year, but changed in the direction of showing more sincere consideration for each other's point-of-view by the end of the year. If a student took a position on an issue and could support his stand, then his right to have that position was accepted. There was growing mutual respect for each other and for individual ideas.

Some teachers commented that they had to change their own attitudes somewhat. It was difficult for some to subject themselves to the questioning of the children, but they recognized that they must be willing to be challenged, and to show respect for the thinking of children.

Reactions to Pupils' Learning

Generally, the teachers were satisfied with what their pupils learned during the study. This satisfaction was revealed in the following comments: "Pupils developed independence and confidence in reading." "Children seemed to have higher regard for their own ideas and opinions and for those of their classmates." "Healthy skepticism developed during

the year." "Skills learned in critical reading instruction transferred to other areas, such as listening to radio and television presentations and reading in textbooks in subject-matter fields." One second-grade child applied his understanding of the logic rule concerning "all, some, or none" to question a disciplinary comment made by his teacher. Coming into the classroom after recess, the teacher said, "Quiet please! You're all talking at once!" The child replied, "Oh no, Mrs. Z., we're not all talking. In fact, many of us aren't talking."

The above comments show only some of the problems and reactions of the teachers to teaching critical reading in the elementary school. Although the teachers had received instruction in a summer workshop and were provided with units, they still had many problems to overcome. In general, all of the teachers seemed to have enjoyed their experience in teaching critical reading and stated that they planned to teach these skills in future years. The most frequent comment from all teachers was that the teaching of critical reading should not be limited to one year. Rather, it should be started in the first grade and the concepts introduced gradually throughout the child's entire education.

Discussion

Early studies by Anderson (2), Glaser (17), and others have shown that students in junior and senior high school can be taught to improve their critical thinking abilities. It has been assumed by some educators, however, that young children are not capable of critical reasoning. Part of the impetus for this belief came from the observational studies of Piaget (35) who identified the formal thought process, including hypothesizing and checking relationships, as manifesting itself around age twelve. A study by Taba (48), reported in 1964, confirmed Piaget's developmental sequence, but showed that training in thinking accelerated the pace of thought development. Her findings showed that children from the second to the sixth grades can learn to make inferences, generalize, and make logical assumptions at an early age if they receive systematic instruction in thinking skills.

A major purpose of the present research, begun in 1963, was to determine if children in grades one to six could learn to apply critical thinking to printed materials, i.e., could learn to read critically. The results show that the subjects in all of the elementary grades, including first, learned to read critically with instruction. Since random sampling was impossible (see page 30), the technique of analysis of covariance was employed to adjust for initial differences in ability. Prior to the analysis, regression tests were conducted on the scores of the combined groups in each treatment. The results of these tests showed that the assumption of homogeneity of regression for the analysis of covariance was satisfied. Thus, the main effect of treatments that

was observed across grade levels can be attributed to the instruction in critical reading.

A reason that teachers often give for excluding critical reading from the program in the primary grades is that it will interfere with their pupils' growth in other basic reading skills. Thus, it is particularly important to note from the results in this study that instruction in critical reading did not interfere with growth in general reading. The experimental group did equally as well as the control group on their general reading scores in grades two through six and better than the control group in grade one. Yet, except in grade one, the added instruction in critical reading did not assist the subjects in doing any better on the general reading test. This gives support to the research of McCullough (32) that general reading and critical reading abilities are not synonymous.

At every grade level, the children in the experimental group did better than the children in the control group on the total critical reading test. When the test was divided into three sections--Logic, General, and Literature--the only consistent difference between the experimental and control groups was on the Logic section. Differences in favor of the experimental group were observed only in grades one and three on the Literature section and in grade three on the General section. The control group did better than the experimental group on the General section in grade one.

The instruction in logic was probably the most unique experience that the experimental groups were given in the study. The fact that most of the teachers and their pupils had not been previously exposed to skills of this type may account for the significant differences observed between treatment groups on this section at all grade levels. Another possible reason may have been the teaching technique utilized. The children were given more direct instruction with explicit criteria for using logical reasoning. In contrast, explicit criteria were not always given for developing the skills measured on the General section of the test since it was more difficult to state such criteria. It is also possible that the items in the General section involved a more complex process since they often required the pupils to compare two reading passages.

Although the control subjects were exposed to literature for the entire academic year, their growth on the Literature section of the critical reading test was not significantly higher than that of the experimentl group. This indicates that the instruction given to the experimental group on the evaluation of literature did have elements that produced equivalent results in a shorter period of time. Since it was impossible to prepare all units prior to the experimental treatment, the units were not counterbalanced to eliminate the effects of order of presentation. This may have affected the results on the Literature section of the test since the literature units came last in the sequence

for the critical reading group and many teachers did not complete all of them. Another possibility for the few significant differences on this section may have been that the test questions were not adequate for testing the higher levels of thinking skills.

As the reader will remember, in order to determine differences between the intact classroom groups at each grade level, a two-by-two (treatment by replication) factorial design was employed. The groups in each treatment were randomly assigned to one of two replications. Regression tests were not conducted on the scores of these subgroups. From the analysis of covariance tests in the study there were several main effects of replications and replication by treatment interactions. The interactions and main effects that occurred are due to some variables that were uncontrolled in the study (see page 46). An analysis of the mean intelligence scores for the subgroups indicates that the interaction and replication effects in grades one, three, and four were caused by differences in intelligence. Differences found between replications on the Logic section of the critical reading test and on general reading in grade two and the interactions that occurred in grade five may be due to dissimilarities of teachers since there were no differences between the mean intelligence scores at those grade levels.

A second major purpose of the research study was to determine the relationship between critical reading ability and certain other factors. As found by other researchers, Glaser (17), Maney (31), and Sochor (46), intelligence was found to be positively related to critical reading. General reading was also highly related to critical reading in this study. When these two variables were combined at each grade level, nonverbal intelligence did not add anything except in grades one and three. If two tests measure substantially the same factor, a linear restraint operates with the result that the test having the lower correlation with critical reading tends to have a lower coefficient in each equation in which both appear. This may be what has happened in the multiple correlations combining the California Achievement Tests in Reading and the Lorge-Thorndike Intelligence Tests.

The analysis of covariance using Intelligence as a major variable in a 2 X 3 X 2 factorial design (treatment, intelligence, and replication) showed that the adjusted mean posttest scores of the high intelligence group were higher than the middle group which were in turn higher than the low I.Q. group at all grade levels. In other words, the higher the I.Q. of the children being taught general reading and critical reading, the more successful will be the teaching attempt. The fact that no treatment by intelligence interactions occurred indicates that treatment effects were the same at each level of I.Q. This means that children at all intelligence levels in the experimental group did better than their counterparts in the control group. Thus, children of all intelligence levels can benefit from instruction in critical reading. Glaser (17) also found that there was a tendency for more intelligent groups to profit most from his training in critical thinking, but he

reported that there were individuals with intelligence scores of less than 100 who were found among those profiting from this training.

Several of the correlations between personality and critical reading in the primary grades were not significant. In the intermediate grades, most of the correlations were significant but low. Since the purpose of investigating the relationship of personality and critical reading ability is a theoretical one, even the small correlations obtained in this study are indicative of a relationship if they are statistically significant. Guilford (22) states that whenever a correlation is found to be statistically different from zero the fact of the small correlation coefficient may merely mean that the measurement situation is contaminated by uncontrolled factors. He states that where any significant correlation is established at all, the fundamental law implies a perfect relationship. It should be noted that many of the non-significant correlations were obtained in the primary grades where the adequacy of the measuring instruments is a problem. A factor possibly contaminating the measurement of personality in this study was the elimination of some items on the Social Adjustment section of the personality test (see page 33).

Analysis of the total scores on the critical reading test showed that subjects in the experimental group performed better than the control subjects at every grade level. The observational data aids in verifying the conclusion that these effects were due to the experimental treatment.

The data from the observational study support the findings of other researchers (5) and (48) that the teacher plays a central role in determining the depth of pupils' thinking. Although the teachers in the control and experimental groups differed in the frequency of particular kinds of questions, Tables 54 and 55 show that a particular kind of question elicited the following similar kinds of responses from both groups of pupils:

Teachers' Questions	Pupils' Responses Elicited
Gathering Specific Facts	Guessing (Level 1), Literal Memory (Level 2)
Interpreting	Inferring (Level 3)
Analyzing	Hypothesizing (Level 4)
Applying	Inferring (Level 3)
Evaluating	Evaluating (Level 5)

It will be noticed that analyzing and evaluating questions elicited the highest levels of responses and that questions to gather specific facts received the lowest levels of responses. In addition, a few differences between the control and experimental groups were noticed in the responses elicited by particular types of questions. These differences were as follows: (1) control teachers' interpreting questions

received more hypothesizing responses than expected, (2) experimental teachers' analyzing questions produced more evaluating and inferring responses than expected, and (3) experimental teachers' evaluating questions elicited more hypothesizing responses than expected.

It is particularly interesting to observe that interpreting questions elicited hypothesizing responses (Level 4) for the control teachers but not for the experimental teachers and that analyzing questions produced evaluating responses (Level 5) for the experimental teachers but not for the control teachers. These differences indicate that some factor other than question type--such as amount of instruction, or the content, purpose and quality of the question--may have influenced the results in these categories.

A comparison of the experimental and control teachers for different periods of time (Tables 48, 49, and 50) in the study shows that the experimental group asked significantly more analyzing questions throughout the year with more clarifying questions in the fall and more evaluating questions in the spring. In contrast, the control teachers asked more interpreting questions throughout the year and more applying questions in the winter and spring. The special materials and teacher training may be reasonably credited for the difference in the types of questions asked by the two groups. The materials for the experimental group contained many evaluating and analyzing questions whereas the control materials employed factual, interpreting and applying questions. Thus, the observational data indicate that the teachers used the lesson plans provided.

One category of questions was generally ignored by both groups of teachers. Only at the sixth-grade level in the experimental group were the observed frequencies greater than the expected frequency in the summarizing category. An analysis of the recordings, tapescripts, and the observational data regarding teachers' statements suggests that the teachers tended either to provide the summarizing comments themselves or to omit them.

In general, data revealed no consistent gradual increase in the use of more thought-demanding questions at the higher grade levels. Experimental teachers in grades one and two (Table 47), however, did ask a larger number of specific fact questions and teachers in grade six asked fewer specific fact questions and more evaluating questions. As as result, there were a high number of literal responses from pupils in grades one and two and more evaluating responses in grade six in the experimental group.

The data for all twenty-four teachers indicate that established personal habits of questioning persisted throughout the year. For various classrooms the observations show that some teachers, regardless of grade level taught, favored factual and applying questions whereas others emphasized analyzing and evaluating questions.

The observational data presented in this report are subject to the usual limitations of such studies. For example, it was difficult at times for the observers to do on-the-spot coding of behavior. Verbal interaction could not always be categorized precisely and the unit of behavior could not always be clearly recognized. There may have also been observer bias since all of the observers were staff members of the Critical Reading Project and knew the purposes of the study. However, all observers were not necessarily committed to the idea that special instruction would be more effective than wide exposure to books in producing critical reading responses, i.e., that Treatment one was better than Treatment two.

The best measure of the above effects was the periodic checking of observer reliability by means of the Spearman-Brown Prophecy formula. Coefficients ranged between .67 and .97 with a mean of .84 on teacher behavior and between .61 and .87 with a mean of .73 on pupil behavior. It would seem then that the problems of categorization and observer bias were minimized, unless all observers were concurrently guilty of the same mistakes and biases.

It was impossible to check the problem of reactive arrangement on the part of the subjects and teachers, but the fact that both control and experimental groups received instruction should have minimized this effect across treatments. Although the teachers and pupils knew when the observers were coming to the classroom, they were unaware of the specific objectives of the study or what the observers were recording. All teachers were informed that the observers were noting the children's verbal behavior.

The sampling problem affecting the ANCOVA data for intact classroom groups within replications did not affect the observational data since classroom groups within treatments were combined at each grade level.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Three major purposes formed the framework for this study. These purposes were (1) to determine whether critical reading skills can be taught to elementary school children while normal progression in other basic reading skills is maintained, (2) to determine the relationship between certain factors and critical reading ability, and (3) to determine what kinds of teacher verbal behavior elicit critical responses from children.

Conclusions

The conclusions related to these purposes are stated here in summary form, along with a brief restatement of some of the relevant findings. Internal validity was established by the use of statistical controls, multiple measures, and internal analysis of sampling characteristics, but limitations of generalizability of the results, due to the nature of the sampling, should be noted.

The Feasibility of Teaching Critical Reading

1. Children in grades one through six can learn to read critically. The experimental groups' mean total scores on the critical reading test were higher than the control groups' scores at all grade levels although the difference was marginally significant in grades two and six.

2. Teaching children to apply logical reasoning to printed materials is one effective means of increasing their growth in critical reading ability. The experimental group scored consistently higher than the control group at every grade level on the Logic section of the critical reading test.

3. The results with regard to the General and Literature sections of the critical reading test were inconclusive. Although children in the experimental group performed better than the control group on the Literature section in grades one and three,

the difference was at a marginal level of significance in grade one. The experimental group scored higher than the control group on the General section in the third grade but lower ($p < .10$) than the control group in grade one. No differences between treatments were found on these two sections at the other grade levels.

4. Grade level appears to have had some effect on critical reading performance. Subjects in grade three scored higher than those in grade two only on the Logic section of the critical reading test. In contrast, subjects in grade four scored lower than those in grades five and six on each measure of critical reading.

5. Instruction in critical reading does not interfere with elementary school children's growth in other basic reading skills. There were no significant differences between the two treatments at any grade level on the California Achievement Tests in Reading except in grade one. In grade one, the experimental group did better than the control group on general reading although it was at a marginal level of significance.

Factors Related to Critical Reading Ability

1. General reading ability is highly related to critical reading ability. The good critical reader will also tend to be a good reader in general. General Reading Total and Comprehension were the variables correlating the highest with critical reading at most grade levels.

2. Intelligence is also related to critical reading ability. The highest correlation of intelligence and critical reading scores were .792. However, when General Reading and Nonverbal Intelligence are combined, intelligence in most instances does not add significantly to the correlation. It appears that the California Achievement Tests in Reading and the Lorge-Thorndike Intelligence Tests may substantially measure the same factor. When the scores from these two tests were combined, a linear restraint may have been operating with the result that intelligence, since it had a lower correlation with critical reading, tended to have a lower coefficient in each equation in which both appeared.

   a) In general, children of higher intelligence levels perform better on critical reading than middle I.Q. children who in turn perform better than low I.Q. children. The analysis of covariance data to determine whether the factor of intelligence influenced scores on the criterion

measures showed that this pattern occurred at all grade levels.

b) Children of all intelligence levels who receive instruction can learn to read critically. The analysis of covariance data on intelligence differences revealed no interactions. This meant that when the experimental groups obtained higher mean scores than the control groups, the differences were significant across intelligence levels. Thus, in the experimental group, the low, as well as the high and middle intelligence groups, performed better than their counterparts in the control groups.

3. The relationship between personality factors and critical reading ability was low. In grades five and six, the correlations between the two factors were slightly higher than in the other grades.

4. Instruction in critical reading does not change the relationship between critical reading ability and the variables of Intelligence, General Reading, and Personality. The data indicate that there were no systematic differences in the correlations of the independent with the dependent variables before and after instruction.

5. Children of both sexes benefit equally from instruction in critical reading. The analysis of covariance tests revealed no significant differences between the sexes at any grade level except on Logic for grade five in favor of the girls.

<u>Verbal Interaction</u>

1. Teachers ask more questions than they make statements. The observation data revealed that the ratio of questions to statements for both the control and experimental teachers was approximately four to one.

2. Special materials and instruction influence the kinds of questions teachers ask.

   a) The experimental teachers who received materials and instruction in teaching critical reading asked more analyzing and evaluating types of questions. The control teachers who received instruction and materials for teaching children's literature asked more specific fact, interpreting, and applying types of questions.

   b) Differences between the questions of the two groups appeared throughout the year. In the fall, the control

teachers asked more questions than the experimental teachers in the categories of gathering specific facts and interpreting; in the winter and spring they asked more questions in the categories of interpreting and applying. In contrast to the control teachers, experimental teachers asked more clarifying and analyzing questions in the fall, more analyzing questions in the winter, and more analyzing and evaluating questions in the spring.

3. The kinds of questions teachers ask influence the depth of pupils' thinking. In both the control and experimental groups, teachers' questions to gather specific facts elicited guessing and literal responses whereas analyzing and evaluating questions produced the responses of hypothesizing and evaluating from pupils.

4. Some factor in addition to type of question appears to influence somewhat the level of the pupils' responses. Teachers' interpreting questions elicited hypothesizing responses in the control group but not in the experimental group; teachers' analyzing questions elicited evaluating responses in the experimental group but not in the control group.

5. Children who receive instruction in critical reading give more evaluating responses and fewer literal memory and inferring responses than their counterparts who do not receive such instruction.

6. There are no systematic differences across grades in either the teachers' questions or the pupils' responses. However, experimental teachers in the first and second grades did ask more specific fact questions and their pupils gave more literal memory responses whereas experimental teachers in the sixth grade asked more evaluating questions.

Implications and Recommendations

There were two major phases--developmental and experimental--to the research in critical reading. Both the products from the developmental phase and the results from the experimental phase have implications for teachers and researchers in reading.

The developmental phase resulted in several products. During the first stage of the project, a comprehensive, operational definition of critical reading was developed. This definition differs from most in that it is highly detailed and encompasses skills for the critical reading of all kinds of materials including argumentative, informational,

and literary. Teachers and researchers should find this definition helpful in listing the components of critical reading in order to develop materials and lessons for teaching these skills.

Three tests were constructed during the developmental phase. These tests were nationally normed and reliability was established at each grade level. Because of the paucity of critical reading tests for grades one through six, these instruments provide teachers and researchers with a needed tool for assessing critical reading ability in the lower grades.

There were a number of lessons developed for the experimental phase. Although these lessons have not yet been individually tested, and thus are not being published at present, the sample lessons presented in Appendix C should provide ideas for teachers to use in developing their own lesson plans. The project staff hopes that eventually these lessons will be individually tested and available for teachers to use.

Another useful product from the developmental phase was an observational scale constructed specifically for the recording of discussions on critical reading. The scale provides for the recording of teachers' verbalizations and for the use of pupils' responses as the criteria of the effectiveness of teacher's comments and questions. The categories that formed the classification system for the teachers' verbalizations was influenced by Bloom's approach to ways of ordering knowledge. The main criterion in determining the pupils' categories was the differentiation of the levels of thinking evident in their responses. The mental operations as identified by Guilford in the structure of the intellect proved useful in defining the types of thinking. This scale was specifically designed to provide the researcher with a tool for recording teachers' verbalizations and for recording the pupils' responses in lessons on critical reading.

The implications from the results of the experimental phase are fairly clear-cut in some instances and merely suggestive in others. It is obvious from the study that elementary school children can be taught to read critically, even in the primary grades. Since there is no detrimental effect to the general reading program, a reason often given by teachers for not including critical reading in the reading program, it appears that instruction in critical reading should be made a part of the curriculum starting in the first grade. The study of logical reasoning, which in the past has often been considered a subject for college classes only, was effective in influencing critical reading ability in elementary school children. This finding agrees with other current research results, for example, those of Suppes and Binford (47). The study of logic may begin in the first grade and continue throughout the elementary grades. Children at all grade levels learned to detect generalizations; to recognize the fallacious use of all, some, or none; and to detect fallacious reasoning in selected advertisements and commercials. Although an attempt was made to teach first and second

graders to test the validity of syllogisms, and they often succeeded in doing so, it is suggested that such teaching begin in the third grade. From teachers' comments it appears that pupils above the second grade do not have too much difficulty in testing the validity of a syllogism when the first major premise is true. However, when the first major premise is false, it so hinders the children's thinking that they cannot move beyond. For example, when the statement "All girls are smart" is made, the boys begin questioning the premise and confuse the factually incorrect premise with a logically sound syllogism. According to the research of Henle (24), graduate students make the same error. From her study and that of Suppes and Binford who found that children in the fourth grade can learn to use logical reasoning as well as students in college, it appears that teaching logical reasoning to elementary school children may be almost as easy as teaching it to older children. According to Suppes and Binford, teaching logic to younger children takes longer, and according to the observations in the present study it requires the use of materials and examples appropriate to the pupils' grade and maturation level.

The results on the Literature section of the critical reading test suggest that literary analysis may be another effective means of teaching critical reading. In spite of the fact that the control group had received general instruction in reading literature for an entire academic year, the experimental group did as well as the control group on the Literature section of the test at most grade levels and better than the control group at two grade levels. However, at this point, the results are more suggestive for researchers than teachers. Further research is needed to clarify whether literary criticism, if taught in the elementary grades, results in critical readers of literary materials.

Perhaps the most interesting finding on factors related to critical reading is that children of all intelligence levels who received instruction did better than their counterparts who did not receive such instruction. This indicates that children of all intelligence levels in the classroom can benefit from instruction in critical reading.

There was no difference between boys and girls and their gain in critical reading. Most researchers have found that girls are better than boys in reading. Also, it has been commonly accepted by many educators that boys are better critical thinkers than girls. This study indicates that both boys and girls can benefit equally from instruction in critical reading.

The fact that personality was not highly related to critical reading in this study may be a measurement problem rather than a theoretical one. Suggestions have been made to the project staff that projective techniques for measuring personality would have been preferable to the measuring instruments used. It may be that the factors measured by the personality test really have little or no relationship to critical reading. The most prevalent factors measured by other researchers have been children's attitudes, biases, and open-mindedness (27) and (21). These factors

have been shown to have a bearing on the child's ability to read critically. Since no measuring instruments of attitudes or open-mindedness were available across grades one through six, the California Test of Personality was accepted as a second-best choice. It would be interesting for researchers to develop instruments to measure the factors of attitude, bias and open-mindedness extending down to the first grade and to see how these factors influence critical reading throughout the grades.

An analysis was made in this study of any differences between the relationship of factors of Intelligence, Personality and General Reading to Critical Reading before and after instruction. Ennis (15) hypothesized in a recent theoretical article that instruction should decrease the relationship between intelligence and critical thinking if instruction does improve critical thinking. No change in the relationships between these factors and critical reading ability was detected in this study but the analysis of covariance data do indicate that instruction improved critical reading. Thus, teachers may expect intelligence and general reading ability to continue to influence critical reading even after their children are involved in a critical reading program.

In a dissertation (30) using the subjects from this research study it was found that creativity is not related to critical reading ability. However, another factor, socio-economic background, appears to have a relationship to the ability of children to learn to read critically. Although the correlations of this factor with critical reading are not presented in this report since the measure of socio-economic background was subject to question, the relationship of the home on the ability to read critically would make an interesting further study.

The results from the observational study are fairly clear-cut. If teachers ask analyzing and evaluating questions they will influence the depth of thinking of the children in their classroom.

Summary

The purposes of this study of the critical reading ability of elementary school children were (1) to determine whether critical reading skills could be taught to elementary school children while growth in other basic reading skills was maintained, (2) to determine the relationship between certain factors and critical reading ability, and (3) to determine what kinds of teacher verbal behavior elicited critical responses from children.

The sample consisted of twenty-four intact classroom groups in grades one through six, four at each grade level. Two of these groups were assigned to the control group and two were assigned to the experimental group. The subjects in the experimental group received instruction

in critical reading while the subjects in the control group received instruction in children's literature to minimize the Hawthorne effect. Prior to the experimental phase, two training workshops were conducted--one in critical reading and one in children's literature. Teachers for the study were volunteers from these workshops. In September, pretests in general reading and critical reading were administered to the subjects in grades two through six. Each teacher was then given a teaching unit and instructed to teach two lessons per week. The remaining units were periodically sent to the teachers throughout the year. Each class was observed six times throughout the year during the teaching of the units, and assistance was given to the teachers through individual conferences and two one-day training sessions in the fall and in the middle of the year. At the end of the academic year, the critical reading and general reading tests were administered again. Indications of intelligence and personality were obtained through tests administered in January (I.Q.) and May (Personality). The procedures for the subjects in grade one were the same except pretests of the criterion measures were not administered until January.

In order to determine whether there were differences between the experimental group and control group after instruction on critical and general reading, analysis of covariance tests were conducted on the Total of the critical and general reading tests and on the critical reading sub-tests of Logic, General and Literature.

At every grade level, the mean scores of the experimental group were significantly higher on the Critical Reading Test Total than those of the control group. However, the differences were at a marginal level of significance in grades two and six. An analysis of the sections of the critical reading test showed that only on the Logic section was the mean score of the experimental group significantly higher than that of the control group at all grade levels. The experimental group did better than the control group on the Literature section in grades one and three. On the general reading test, there were no differences between treatment groups except in grade one where the control group had a higher mean score than the experimental group and in grade three where the experimental group scored higher than the control group.

Pearson product-moment correlations and multiple correlations were computed to determine whether certain factors including general reading ability, intelligence, personality, and selected combinations of these factors were related to critical reading ability. The Total of the California Achievement Tests in Reading and the sub-test of Comprehension were the two variables correlating the highest with the Critical Reading Total across the grades. Also, Verbal Intelligence and Nonverbal Intelligence both correlated highly with critical reading ability. However, when Nonverbal Intelligence and General Reading scores were combined in a multiple correlation with critical reading ability, the Intelligence factor did not add significantly to the correlation.

Many of the correlations between Personality scores and Critical Reading Total were not significantly different from zero. Correlations of the Personality scores and critical reading ability in the fifth and sixth grades were generally low, but significant. It was also found that (1) when the experimental group scored higher than the control group, this was true at each intelligence level, although high I.Q. children did better than low I.Q. children, (2) there were no differences in critical reading ability between boys and girls, and (3) the correlations between Intelligence, General Reading, Personality and the criterion measure of Critical Reading did not change after the year of instruction.

The observation data revealed that special materials and instruction influence the teachers' questions and the students' responses. Teachers in the control group asked more specific fact, interpreting, and applying questions whereas teachers in the experimental group asked more analyzing and evaluating questions. There was a relationship observed between the kinds of questions teachers asked and the level of critical responses given by the pupils. Specific fact questions elicited lower level responses whereas interpreting, analyzing, and evaluating questions brought higher levels of response from pupils. Thus, the children in the experimental group gave more critical responses seemingly as a result of the type of teachers' questions asked.

In addition to an operational definition of critical reading, many materials were developed for this study. These included lesson plans, an observational scale and critical reading tests. These materials and the results of the research should prove useful to researchers and teachers.

REFERENCES

1. Almy, Millie C. "Are They Too Young for Problem Solving?" Progressive Education. Vol. 27, 1950. pp. 148-151.

2. Anderson, H. R.; Marcham, F. G.; and Dunn, S. B. "An Experiment in Teaching Certain Skills of Critical Thinking," Journal of Educational Research. Vol. 38, 1944. pp. 241-251.

3. Arnold, Dwight. "Testing Ability to Use Data in the 5th and 6th Grades," Educational Research Bulletin. The Ohio State University. 1938. pp. 255-259.

4. Artley, A. Sterl. "Critical Reading in the Content Areas," Elementary English. Vol. 37, February 1959. pp. 122-130.

5. Bellack, A., and Davitz, J. R., et al. The Language of the Classroom. New York: Institute of Psychological Research, Teachers College, Columbia University. 1963. 200 p.

6. Betts, Emmett A. "Guidance in the Critical Interpretation of Language," Elementary English. Vol. 27, January 1950. pp. 9-18, 22.

7. Bloom, Benjamin et al. Taxonomy of Educational Objectives Handbook I: Cognitive Domain. New York: David McKay Co., Inc. 1956.

8. Brownell, John A. "The Influence of Training in Reading in the Social Studies on the Ability to Think Critically," California Journal of Education Research. Vol. 4, 1953. pp. 28-31.

9. Campbell, Donald T., and Stanley, Julian C. "Experimental and Quasi-Experimental Designs for Research on Teaching," Handbook of Research on Teaching. American Educational Research Association. 1963. pp. 171-246.

10. Chase, Francis S. "Demands on the Reader in the Next Decade," Controversial Issues in Reading and Promising Solutions. Supplementary Educational Monographs, No. 91. Chicago: University of Chicago Press. 1961. pp. 7-18.

11. DeBoer, John J. "Teaching Critical Reading," The Elementary English. Vol. 23, October 1946. pp. 251-254.

12. Durrell, Donald F., and Chambers, J. Richard. "Research in Thinking Abilities Related to Reading," The Reading Teacher. Vol. 12, December 1958. pp. 89-91.

13. Ennis, Robert. "A Concept of Critical Thinking," Harvard Educational Review. Vol. 32, No. 1. Winter 1962. pp. 81-111.

14. Ennis, Robert. "Critical Thinking Readiness in Grades 1-12," Cooperative Research Project No. 1680. Ithaca, New York: Cornell University. April 1962.

15. Ennis, Robert H. "Needed: Research in Critical Thinking," Educational Leadership. October 1963. pp. 17-20, 39.

16. Gans, Roma. A Study of Critical Reading Comprehension in the Intermediate Grades. New York: Bureau of Publications, Teachers College, Columbia University. 1940. 129 p.

17. Glaser, Edward M. An Experiment in the Development of Critical Thinking. Teachers College, Columbia University. No. 843. 1941. 199 p.

18. Gray, William S. "Basic Competencies in Efficient Reading," Reading in an Age of Mass Communication. Edited by W. S. Gray. Chapter 4. New York: Appleton-Century-Crofts. 1949.

19. Gray, William S., and Rogers, Bernice. Maturity in Reading. Chicago: University of Chicago Press. 1956. 273 p.

20. Grener, Norma, and Raths, L. E. "Thinking in Grade III," Educational Research Bulletin. Vol. 24, 1945. pp. 38-42.

21. Groff, P. J. "Children's Attitudes Toward Reading and Their Critical Reading Abilities in Four Content-Type Areas," Journal of Educational Research. Vol. 55, April 1962. pp. 313-319.

22. Guilford, J. P. Fundamental Statistics in Psychology and Education. New York: McGraw-Hill Book Company, Inc. 1956. 565 p.

23. Guilford, J. P. "Intellectual Factors in Productive Thinking," Productive Thinking in Education. Edited by Mary Jane Aschner and Charles E. Bish. National Education Association. 1965.

24. Henle, Mary. "On Error in Deductive Reasoning," Psychological Reports. Vol. 7, 1960. p. 80.

25. Hyram, George H. "An Experiment in Developing Critical Thinking in Children," Journal of Experimental Education. Vol. 26, December 1957. pp. 125-132.

26. Kay, Sylvia C. "Critical Reading: Its Importance and Development," The English Journal. Vol. 35, 1946. pp. 380-385.

27. Kemp, C. Gratton. "Improvement of Critical Thinking in Relation to Open-Closed Belief Systems," The Journal of Experimental Education. Vol. 31, No. 3 March 1963. pp. 321-323.

28. Lorge, Irving, and Thorndike, Robert L. Lorge-Thorndike Intelligence Tests. Houghton, Mifflin. 1964.

29. Lundsteen, Sara W. "Critical Listening: An Experiment," The Elementary School Journal. Vol. 66, No. 6. 1966. pp. 311-315.

30. MacDougall, Sister Mary Julia. "Relationship of Critical Reading and Creative Thinking Abilities in Children." Unpublished Ph.D. dissertation, The Ohio State University. Fall 1966.

31. Maney, Ethel. "Literal and Critical Reading in Science," Journal of Experimental Education. Vol. 27, September 1958. pp. 57-64.

32. McCullough, Constance. "Responses of Elementary School Children to Common Types of Reading Comprehension Questions," Journal of Educational Research. Vol. 51, September 1957. pp. 65-70.

33. McKillop, A. S. The Relationships Between the Reader's Attitude and Certain Types of Reading Response. New York: Bureau of Publications, Teachers College, Columbia University. 1952. 101 p.

34. Nardelli, Robert C. "Some Aspects of Creative Reading," Journal of Educational Research. Vol. 50, 1956. pp. 298-302.

35. Piaget, Jean. Judgment and Reasoning in the Child. Patterson, New Jersey: Littlefield, Adams and Company. 1959. 260 p.

36. Piekarz, Josephine A. "Attitudes and Critical Reading," Dimensions of Critical Reading, Proceedings of the Annual Education and Reading Conferences. Compiled by Russell G. Stauffer. Newark, Delaware: University of Delaware. Vol. 11, 1964. pp. 134-144.

37. Raths, Louis. "A Thinking Test," Educational Research Bulletin. Vol. 23, March 1944. pp. 72-75+, 84.

38. Robinson, Helen M. "Developing Critical Readers," Dimensions of Critical Reading. Proceedings of the Annual Education and Reading Conferences. Compiled by Russell G. Stauffer. Newark, Delaware: University of Delaware. Vol. 11, 1964. pp. 1-12.

39. Rogers, Bernice. Directed and Undirected Critical Reading Responses of High School Students. Unpublished Doctoral dissertation, Department of Education, University of Chicago, 1960. 209 p.

40. Russell, David H. Children Learn to Read. Boston: Ginn and Company. 1961. 612 p.

41. Russell, David H. "The Prerequisite: Knowing How to Read Critically," Elementary English. Vol. 40, 1963. pp. 579-582, 597.

42. Shores, J. Harlan, and Saupe, J. L. "Reading for Problem-Solving in Science," Journal of Educational Psychology. Vol. 44, March 1953. pp. 149-158.

43. Smith, Madorah E. "The Preschool Child's Use of Criticism," Child Development. Vol. 3, 1932. pp. 137-141.

44. Smith, Nila B. "What is Critical Reading?" Elementary English. Vol. 40, April 1963. pp. 409-410.

45. Sochor, E. Elona. "Literal and Critical Reading in Social Studies," Journal of Experimental Education. Vol. 27, 1958. pp. 49-56.

46. Sochor, E. Elona. "The Nature of Critical Reading," Elementary English. NCTE, Champaign, Illinois. Vol. 36, 1959. pp. 47-55.

47. Suppes, Patrick, and Binford, Fredrick. "Experimental Teaching of Mathematical Logic in the Elementary School," The Arithmetic Teacher. Vol. 12, March 1965. pp. 187-195.

48. Taba, Hilda; Levine, Samuel; and Elzey, Freeman F. Thinking in Elementary School Children. U. S. Office of Education. Cooperative Research Project No. 1574. San Francisco: San Francisco State College. April 1964. 207 p.

49. Thayer, Leo O., and Pronko, N. H. "Factors Affecting Conceptual Perception in Reading," Journal of General Psychology. Vol. 41, July 1959. pp. 51-59.

50. Thorpe, Louis P.; Clark, Willis W.; and Tiegs, Ernest W. California Test of Personality. California Test Bureau, Monterey, California. 1953 Revision.

51. Tiegs, Ernest W., and Clark, Willis W. Technical Report of the California Tests. California Test Bureau, Monterey, California. 1957 Edition, 1963 Norms.

52. Waetjen, Walter B. "Is Learning Sexless?" NEA Journal. May 1962. pp. 12-14.

53. Wann, Kenneth, and others. Fostering Intellectual Development in Young Children. New York: Bureau of Publications, Teachers College, Columbia University. 1962. 140 p.

54. Watson, Goodwin. "Resistance to Change." Union, New Jersey: Laboratory for Applied Behavioral Science, Newark State College. (Mimeographed copy)

55. Wolf, Willavene; Huck, Charlotte; King, Martha; and Ellinger, Bernice D. The Ohio State University Test of Critical Reading Ability. To be published by The Ohio State University Press.

APPENDIX A

PILOT OBSERVATION STUDY

PILOT OBSERVATION STUDY

As a preliminary phase of the Critical Reading Project, a pilot study was undertaken to ascertain the kinds of teacher behavior that elicit critical responses from children. Although there were indications that critical reading was seldom being taught in the public schools, reading supervisors in the area identified a few teachers who were teaching it to some degree. Thus, the purposes of the pilot observation study were (1) to determine if selected teachers were teaching reading in such a manner as to elicit critical responses from children, (2) to see if the project staff could influence the number of critical responses that teachers obtained from children by writing lesson plans incorporating techniques purported to be effective for teaching critical reading, and (3) to analyze the question types within and across the teacher-prepared and staff-prepared lessons in order to determine if specific differences existed in the number of critical responses produced.

Procedures

Observation Instrument

An observation scale for collecting data on verbal interaction related to critical reading was needed for this study. Attempts were made to use or adapt several existing scales. However, the observers found that the specific verbal behaviors of interest were not appearing on the observation protocols and that extraneous data were being gathered. Thus, after several observations with each scale it was decided that a specially-developed scale was needed. The unique requirement for this scale was that data needed to be collected on (1) the critical responses of children, and (2) the type of teacher questions that elicited such responses. Using these criteria, a scale was developed and tested in which the teacher questions were recorded on the horizontal rows and the children's responses were categorized in the vertical columns. Responses were recorded in a numerical sequence in order to preserve the relationship between the specific teacher comment and the pupil response or chain of responses to that comment. This procedure enabled the observers to record the number and sequence of critical and non-critical responses elicited by teacher questions. Teacher statements did not elicit enough pupil responses to warrant analysis.

The teacher behaviors which were analyzed were divided into three categories: (1) gathering information, which included the teacher's

asking the pupils for specific ideas and facts gleaned from their reading material, (2) refining and clarifying information, which included the teacher's asking pupils to explain, rephrase or give illustrations, and (3) applying and evaluating information, which included questions requiring the pupils to use or evaluate information from the reading material or apply it to another situation.

Pupil responses were classified as critical or non-critical, depending upon the type of thinking exhibited. A response was defined as non-critical if it were simple recall or literal comprehension. A response was recorded as critical if the student went beyond the literal meaning, used data to make an evaluation, interpreted or extrapolated from facts, or detected logical fallacies in the material.

The measurement of critical responses was based on the verbal reactions of pupils in class discussions of reading materials, and the analysis of verbal behavior in this study was limited to the questions asked by teachers and the students' verbal responses to these questions.

Observations

The observational sample was composed of thirty teachers who were identified by their supervisors and the Critical Reading Project staff as being outstanding teachers of reading who were teaching critical reading skills to some degree.

Two observers were trained to use the observation scale by extensive use of tape recordings and classroom visits for a total of sixty observations. On-the-spot categorization was done along with audio tape recordings of the lessons. The tape recordings served later as a source for checking the recorded protocols. Inter-rater reliability coefficients, using the coefficient of concordance, for the teacher categories were equal to or greater than .83 (sig. at $p < .05$ level) for all lessons, while inter-rater reliability coefficients for the pupil categories were equal to or greater than .51 (sig. at $p < .05$ level) for all lessons.

The purpose of the first observation was to determine if teachers, in their discussion of reading materials with pupils, were eliciting critical responses and, if so, what types of questions were eliciting such responses. Teachers were given a brief general definition of critical reading and were asked to use techniques which they believed would be successful in teaching such skills. Thus, only a minimal attempt was made to structure teaching behavior on the first observation. For the second observation, each teacher was asked to use a lesson which had been previously developed by the project staff. These lessons varied in content for each grade level but were similar in the types of questions that were asked. Questions which required the students

to apply and to evaluate ideas from printed materials were included in most of these lessons. Thus, there was a definite attempt to structure teaching behavior for the second observation.

Results and Tentative Conclusions

Since the number of teacher questions and pupil responses differed in the lessons observed, data were analyzed in terms of proportions. A significance level of .01 was set as the rejection point for all data.

Feasibility of Teaching Critical Reading

The data were analyzed to determine if teacher-prepared and staff-prepared lessons did elicit critical responses, and, if so, whether there were significantly more critical than non-critical responses in each instance. The results of the chi-square analysis reported in Table I show that each lesson did elicit critical responses and in each instance the number of critical responses was significantly higher than the number of non-critical responses. Using a z test of proportions it was found that there was a significantly higher number of critical responses to questions in the staff-prepared lessons than in the teacher-prepared lessons.

TABLE I

RESPONSES ELICITED BY STAFF-PREPARED AND TEACHER-PREPARED LESSON PLANS

	Responses		
Lesson Plans	Critical	Non-Critical	X^2
Teacher-Prepared	803	580	35.96*
Staff-Prepared	1433	333	685.16*

Critical Responses by Lesson Plan $z = 13.53$, $p < .01$

*$p < .01$, two tailed test

Thus, selected teachers were shown to be teaching in such a manner as to produce the responses labeled as critical by the project staff. Also, when teachers used the lesson plans which were developed for the specific purpose of eliciting higher levels of thinking they obtained more critical responses than when they used their own lesson plans in which a more general approach was used.

Determinants of Critical Responses

In order to determine how critical responses are induced and why the staff-prepared lesson plans elicited more critical responses than the teacher-prepared lesson plans, further analysis focused upon the following: (1) What types of questions did the teachers ask? (2) What types of questions elicited the greatest number of critical responses? and (3) Were there any differences in the number of critical responses to question types between the two lesson plans?

Kinds of Questions Asked

Table II presents the number of questions of each type asked by teachers in the two lesson plans. There was no difference in the total number of questions asked when different lesson plans were used. Yet the overall chi-square indicates that there was a lesson plan by question type association. This was due to the significantly higher number of refining-clarifying questions and the significantly lower number of questions to gather information asked by the teachers when they were using the staff-prepared lesson plans. There was no difference between the number of applying-evaluating questions asked between the two types of lesson plans.

TABLE 2

TYPE OF TEACHERS' QUESTIONS
BY LESSON PLAN USED

Question Type	(1) Teacher Lesson Plan		(2) Staff Lesson Plan		N	z of diff.
	n	p	n	p		
(A) Gathering Information	371	.34	219	.22	590	6.00*
(B) Refining-Clarifying	128	.12	238	.24	366	7.06*
(C) Applying-Evaluating	597	.54	535	.54	1132	0.00 n.s.
Total	1096	1.00	992	1.00	2088	

Total Number of Questions by Lesson Type $X^2 = 5.29$ n.s.
Question Type by Lesson Type $X^2 = 69.39$, $p < .01$
*$p < .01$, two tailed test

Types of Questions that Elicited the Greatest Number of Critical Responses

There was a question type by response type association in the teacher-prepared lessons ($X^2 = 263.14$ $p < .01$) which was due to the high number of non-critical responses to gathering information questions and the high number of critical responses to applying-evaluating questions. In the staff-prepared lessons there was also a question type by response type association ($X^2 = 509.18$, $p < .01$) which was due to the high number of critical responses to refining-clarifying and applying-evaluating questions.

The bottom portion of Table III presents the z test of difference between critical responses to various question types for both the teacher-prepared and staff-prepared lessons. It can be noted that in the teacher-prepared lessons there was no significant difference between the number of critical responses to questions to gather information (A) and questions to refine and clarify (B). In contrast, applying-evaluating questions (C) produced a significantly higher number of critical responses than either of the other question types. There were similar findings for the staff-prepared lessons with the exception that questions to refine and clarify received a significantly higher number of critical responses than did questions to gather information.

TABLE 3

DIFFERENCES IN THE NUMBER OF CRITICAL RESPONSES TO THE TYPE OF QUESTIONS BETWEEN THE TYPES OF LESSON PLANS

	Response Type												z of Difference of Responses to Question Types Between Lesson Plans 1 and 2
	(1) Teacher Lesson Plans						(2) Staff Lesson Plans						
	Critical		Non-Critical		Total		Critical		Non-Critical		Total		
Question Type	n	p	n	p	N	P	n	p	n	p	N	P	
(A) Gathering Information	110	.26	310	.74	420	1.00	117	.37	197	.63	314	1.00	3.33*
(B) Refining-Clarifying	17	.41	24	.59	41	1.00	287	.81	66	.19	353	1.00	5.71*
(C) Applying-Evaluating	676	.73	246	.27	922	1.00	1029	.93	70	.07	1099	1.00	12.50*
Total	803	.58	580	.42	1383	1.00	1433	.81	333	.19	1766	1.00	

Z OF DIFFERENCE BETWEEN CRITICAL RESPONSES TO QUESTION TYPES

For Teacher Lessons	For Staff Lessons
A - B = 2.05 n.s.	A - B = 11.89*
A - C = 17.41*	A - C = 23.75*
B - C = 5.33*	B - C = 7.76*

*$p < .01$, two tailed tests

Differences Between Types of Lessons

Further inspection of Table III reveals a higher percentage of critical responses to all question types in staff-prepared lessons. Through comparing Table II and Table III it may be seen that (1) there was no significant difference in the number of applying-evaluating questions asked in the two lesson plans, yet applying-evaluating questions in the staff-prepared lessons received a significantly higher number of critical responses and (2) there was a significantly lower number of gathering information questions asked in the staff-prepared lessons, yet more critical responses were elicited. Therefore, it appears that the high number of critical responses to gathering information and applying-evaluating questions was not due to the number of questions asked but rather to some other factor. Refining-clarifying questions occurred more frequently and elicited a higher number of critical responses in staff-prepared lessons than in teacher-prepared lessons.

Conclusions

1. Selected teachers were teaching in such a manner as to elicit critical responses.

2. The number of critical responses elicited was increased through the use of special lesson plans.

3. Some types of questions are more effective than others in eliciting critical responses. Applying-evaluating questions elicited the highest number of critical responses, refining-clarifying the second highest number, and gathering information the lowest number of critical responses.

4. It appears that the increase in the number of critical responses elicited in the second lesson was affected by a factor, or factors, in addition to type of question.

Summary

The purposes of this pilot study were to determine (1) if critical reading was being taught in the public elementary schools, (2) if the number of critical responses could be affected by specially-written lesson plans, and (3) if any particular question type elicited more critical responses than another.

An observation instrument was developed with three question categories -- gathering information, refining-clarifying, and applying-evaluating. Pupil responses were categorized as critical or non-critical.

Thirty teachers who had been identified as teaching critical reading were each observed twice. Teacher-prepared lessons were taught during the first observation and staff-prepared lessons were taught during the second observation. Records of pupil responses revealed that selected teachers were teaching in such a manner as to elicit critical responses and that the number of critical responses elicited was affected by specially-designed lesson plans. Question types were analyzed to determine the number of critical responses elicited by each type and the analysis shows that applying-evaluating questions were more effective for producing critical responses than the other two question types. Questions to gather information were least effective for producing critical responses but they seemed to be necessary in lessons directed toward critical reading.

APPENDIX B

INITIAL AND REVISED BEHAVIORAL DEFINITION OF THE MATURE CRITICAL READER

INITIAL BEHAVIORAL DEFINITION OF THE MATURE CRITICAL READER

A. The mature critical reader is one who possesses the following attitudes:

1. An attitude of open-mindedness toward reading content.
2. An attitude of willingness to expose oneself to a variety of materials.
3. An inquiring or questioning attitude about reading.
4. An attitude or suspended judgment concerning reading.

B. The mature critical reader is one who demonstrates the following abilities of logical inquiry and problem solving:

1. The ability to recognize that the publisher's motive, bias and financial commitment may influence the selection and presentation of materials.
2. The ability to determine the author's motive, his point of view, biases, and background of experience.
3. The ability to make comparisons of similar content from various sources.
4. The ability to compare content with one's own background of experience.
5. The ability to locate and select pertinent information bearing on a specific problem.
6. The ability to distinguish between facts and opinions; the ability to identify inaccuracies and fallacies.
7. The ability to recognize omission of pertinent data.
8. The ability to recognize limitations of personal knowledge and background.
9. The ability to see the relationship between one part and another of the author's organizational pattern.
10. The ability to see relationships among several items of data.
11. The ability to draw inferences which are not specifically stated in the data.
12. The ability to understand and identify the devices used to make the reader react according to a certain pattern:

    a) Appealing to emotion instead of reason.
    b) Using glittering generalities.
    c) Getting indorsement from some prominent person.
    d) Inferring a relationship between two objects which does not exist.
    e) Omitting obvious facts.
    f) Avoiding source of information.
    g) Encouraging one to join the band wagon.

13. The ability to assess literary merit.

14. The ability to identify such literary devices as humor, satire, symbolism, and to detect mood of tone.

C. The mature critical reader continuously makes judgments based upon:

1. The available facts and verifiable evidence.
2. The experience of the reader.
3. The value system of the reader.

REVISED DEFINITION OF THE ABILITIES OF THE MATURE CRITICAL READER*

General Abilities

A. The ability to recognize reading material as one important source of ideas or information and to relate other sources such as television, pictures, etc., or the child's own personal observations of his world.

B. The ability to read and understand a variety of reading materials which represent differing interpretations or view points.

C. The ability to question as one reads, to phrase possible answers, and then to read further for the information that will act as a guide for the conclusion that: (1) there is more than one answer to the question, (2) there is no conclusive answer to the question, or (3) there is one answer to the question.

D. The ability to continue reading until one has gathered enough information to reach as complete an answer or to make as sound a judgment as he can presently make.

Specific Abilities

E. The ability to analyze what is read for the purpose of identifying the author's purposes, point of view or prejudices (and then determine how the author's purposes, etc., relate to one's own set of values and opinions or to the values and opinions of others).

F. The ability to analyze what is read for the purpose of identifying the publisher's purposes, point of view or prejudices; to determine how these influence the publisher's selection and promotion of materials; and finally to relate these to one's own values and opinions or to the values and opinions of others.

G. The ability to determine the author's reputation as a knowledgeable and reliable source of information in a specific

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*No one lesson in critical reading is expected to encompass all of these abilities. The number of abilities emphasized in one lesson may be one or more depending on grade level, lesson material, teacher's purposes, etc.

field or as a recognized writer of quality material.

H. The ability to see relationships while reading that are not directly stated by the author (draw inferences): for example, to read the author's description which indicates but does not directly state that the setting is a spring morning; or, to read the author's subtle wording which hints at but does not directly state his opinion, and then to relate that opinion to the reader's own, perhaps for forming a new opinion.

I. The ability to tell the difference between an author's factual statements and the author's opinion or personal interpretation of fact.

J. The ability to follow the sequence of an author's presentation and to determine how logical or illogical the sequence was.

K. The ability to compare and contrast various (reading) sources in related content areas and determine, on the basis of sound judgment, the worth of each in contributing to one's increase in knowledge in that area.

L. The ability to form an opinion of what one reads, relating what is read to one's past knowledge, and identifying those areas where one lacks enough knowledge for forming a sound opinion.

M. The ability to locate and select the reading materials that will provide the information related to the topic of the study.

N. The ability to recognize when the author has omitted facts or information that are necessary for an honest and complete understanding of some situation or issue.

O. The ability to identify and analyze the devices authors sometimes use to persuade or influence the reader:

1. Appealing to emotion over reason (name calling), (appealing to sympathy).
2. Using glittering generalities.
3. Getting endorsement from some prominent person (testimonial).
4. Inferring a relationship between two objects, or persons, or events which do not exist (identification, transfer).
5. Omitting facts (card stacking).
6. Avoiding source of information.
7. Encouraging one to join the band wagon.
8. Plain folks approach.

P. The ability to analyze and determine the accuracy and the clarity of information presented through such graphic presen-

tations as cartoons, maps, charts, graphs, pictures.

Q. The ability to identify and then analyze the literary form used by the author: fiction, historical fiction, non-fiction, biography, auto-biography, fantasy, fable, myth or legend, folk tale, satire, allegory, etc.

R. The ability to analyze and then form a personal opinion about the literary quality of the material read. Such analysis might concentrate on one or more of the following:

1. Story structure.
2. Character development.
3. The story atmosphere, setting or mood.
4. The author's style or literary devices used: figurative language, symbolism, repetition, understatement, exaggeration, personification, foreshadowing, irony, pun, alliteration.
5. The story theme.

APPENDIX C

ILLUSTRATIVE LESSON PLANS USED IN THE STUDY

PART I. EXPERIMENTAL GROUP

PART II. CONTROL GROUP

PART I

ILLUSTRATIVE LESSON PLANS FOR EXPERIMENTAL GROUP (Critical Reading)

CRITICAL READING GROUP

Logic

Validity and Reliability

Background for the Teacher

The area of logic may appear formidable to the beginner but it can be reduced to a few basic principles. In this unit, we will not attempt to teach "formal logic" but will abstract some of the basic concepts and apply them to material in the elementary school curriculum.

Logic may be thought of in terms of validity and reliability. In attempting to discover whether or not an argument is valid, one must look at its internal consistency. That is, the conclusion must be checked to see if it necessarily follows from the premises. A valid argument is one in which the conclusion must follow, i.e., the conclusion is the only possible statement that could be made if the preceding statements are true. Paragraphs can be reduced to syllogisms for the purpose of evaluating the validity of an argument. The syllogism is the skeleton form of an argument.

Example: All dogs are animals.
Bowser is a dog.
Therefore, Bowser is an animal.

Before the reader can determine the validity of an argument he must be able to answer questions such as the following: What are the basic points, the premises and conclusion both stated and implied, of the argument? Is the author saying that something is always the case, sometimes the case or never the case? Does the conclusion follow logically from the premises given?

An argument may be valid, i.e., internally consistent and at the same time contain inaccurate premises. In this case, it is unreliable. To evaluate the reliability or trustworthiness of an argument or statement the class must use some criterion external to that source. Criteria which may be used are (1) knowledge of the children, (2) other books, magazines or newspapers, (3) films, (4) personal interviews, (5) speakers, etc., and (6) knowledge of the teacher.

Example of a valid but unreliable argument:

All blond-haired people are girls.
Bill has blond hair.
Therefore, Bill is a girl.

The first premise is not trustworthy or reliable and so the conclusion is not trustworthy even though the argument is valid (that is, the conclusion drawn does logically follow from the premises stated). Writers use many techniques to get readers to accept false premises as true. Some of them use words skillfully but inaccurately (these will be found in the unit on semantics) and others go beyond or counter to the evidence. The group of devices incorporating these techniques depend on faulty reasoning or lack of logic. The common fallacies examined in these materials are faulty generalizations (including hasty generalizations, unrepresentative generalizations, faulty causal generalizations, and assuming the cause "post hoc"), propaganda devices (testimonial, transfer, bandwagon, card stacking), and other fallacies (false analogies, false dilemma, all or nothing, composition and division).

It would be good if every trick in reasoning could receive some short and obviously appropriate name, so that when it was used it could be quickly labeled. The lessons in this unit are an attempt to illustrate ways that authors are illogical so that children will be alerted to the devices and hopefully will learn to recognize them in their reading. To achieve clarity in the instructional sessions each form of fallacy or illogical reasoning is presented as a separate entity. However, the common fallacies appearing in context seldom stand out as clearly or are used singularly as presented here. Focusing attention on the gross misuse of logical principles is intended to help children recognize the use of illogical reasoning in smaller degrees.

This section of the unit is for the purpose of teaching children how to check the logic of arguments (validity) using well-established criteria. To check the validity of an argument is simply to determine if given materials are internally consistent. When an author sets forth an argument, he should give several points to support the argument and then reach a conclusion. If the conclusion that he reaches is the only one possible on the basis of the evidence he gives, then the argument is said to be valid. Some authors give several conclusions and no evidence to support them; some give evidence on one point, then jump to another unrelated point; and some reach a conclusion which is inconsistent with the points given. Sometimes inconsistencies are easy to detect. However, many authors are more subtle in their approach and the argument they give looks quite good on the surface. Often it is only through careful examination that the reader can ascertain the invalidity of a conclusion reached. The following lessons are for the purpose of giving children criteria that they may use in judging the validity of arguments and helping them apply that criteria to the printed page.

Few children have had any experience with looking at the structure and internal consistency of arguments. This may be due to the type of

materials, informational in nature, prevalent in elementary and secondary schools. Children are seldom asked to analyze argumentative type statements and determine the logic of such statements. However, such training is essential since arguments abound in newspapers, magazines and other materials which inevitably they will read later in life. Without training in analyzing such materials, students are somewhat at the mercy of the authors.

In the reliability section of this unit, consideration was given to judging trustworthiness of premises or statements through the application of some external criteria. The following lessons will attempt to show the student how to analyze arguments on the basis of internal criteria as well.

The content of Chapters 4 and 5 by Huppe and Kaminsky* was followed closely in developing the lessons for this section of the unit. Lessons cover the following:

1. The four types of logical statements. (Example: All students are lazy. No student is lazy. Some students are lazy. Some students are not lazy.)

2. Converting statements into logical form using all, some, or none. (Example: Americans are patriotic. This must be converted to read ALL Americans are patriotic.)

3. Determining the validity of statements. The simplest form of an argument, the syllogism, should be used here since it is easier for the student to grasp.

4. Determining conclusions from given premises.

5. Finding hidden premises (assumptions).

Exercises on these aspects of validity and others are given in the following pages.

It is important to remember that to check the validity of arguments, the reader must assume temporarily that the premises are "true," since validity is concerned only with the form or structure of the argument. Although he will also check the trustworthiness of the statements (premises), before accepting the conclusion, this is not part of establishing validity.

The following lessons are merely introductory to the area of validity. Teachers should go beyond the lessons as soon as they think

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*Bernard F. Huppe and Jack Kaminsky, Logic and Language (New York: Alfred A. Knopf, 1962), pp. 110-194.

their students are ready and actually apply the principles to printed materials. Students should be taught to strip the premises from the voluminous amounts of material in which they are often imbedded. They must make sure that they have access to all the premises including any that are inferred or implied. Next, they should determine if something is always the case, sometimes the case, or never the case. As soon as children try to analyze entire passages, they will find that a given paragraph usually contains an argument consisting of a series of sub-arguments. The conclusion of one argument serves as a premise of the next argument. These are called sorites. If the students are ready for a lesson of this type the teacher should consult Huppe and Kaminsky, Logic and Language, pp. 136, 137.

Whereas validity is primarily concerned with the relationship between premises and conclusions, reliability deals with the trustworthiness of the premises. An argument can be logically valid, but if one or more of the premises is false or even questionable, then little stock can be put in the conclusion. The best kind of argument depends upon both logical relationships and reliable premises.

One of the best ways to obtain reliable information is to insist that statements be verifiable. When a way of checking whether or not a statement coincides with some actual state of affairs is found, it can be verified. When a statement has been verified, it is reliable. Trying to determine the "truth" of a statement is more an ideal to be sought than one which can be attained. Scientific testing and reasoning are not a guarantee of truth, but rather, a scrupulous means for arriving at a possible truth. Instead of working with "true" statements (statements that cannot be wrong) we must be satisfied with working with reliable statements. The idea that statements are only probable and always tentative is a difficult concept for children to develop.

A statement about a single object can be verified by observing that object but the difficulties increase when the subject changes from a single instance to a statement about many instances; that is, as we generalize. The reliability of a generalization is difficult to establish because it refers to a number of instances or characteristics.

Lessons in this unit deal with recognizing and formulating reliable generalizations, distinguishing between general and specific statements, determining when a generalization is supported by adequate facts, and when faulty reasoning produces an unreliable generalization such as hasty generalizations, unrepresentative generalizations, and faulty causal generalizations.

Other lessons deal with incorrect inferences such as false dilemma, all or nothing, composition and division, band wagon, testimonial and transfer. Still others include examples of fallacious reasoning such as card stacking and false analogies. One series of lessons deals with testing the reliability and accuracy of material in books and newspapers.

General and Specific Statements — Grades 1-6

PURPOSE: To help children distinguish between a generalization and a specific statement of fact.

MATERIALS: Attached sheets.
Examples drawn from the group.

PROCEDURE:

1. Write comparable statements on the board making one specific, one general, such as:

   a. Bill wears glasses.
   b. People who wear glasses have poor eyes.

   c. Nancy has on a pink dress.
   d. All girls like to wear pink dresses.

   e. Jim likes to fish.
   f. Most boys like to fish.

2. Discuss the statements and bring out the fact that one statement is about a specific person and the other gives information about a group.

3. Write more examples of specific and general statements on the board illustrating one instance vs. several; one thing vs. many things.

   a. This piece of chalk is broken.
   b. Chalk is white (or yellow).

   c. Tom is reading a book.
   d. Children usually read in school.

4. Attempt to draw a definition of a generalization from the group.

5. Read some of the following paragraphs and ask the students to make an accurate generalization about the information given.

   a. The children in Miss Jones's room enjoyed the puppet show. The children in Miss Smith's room enjoyed the puppet show, too.
   b. Tom, Ted, Bill, John, Mike (or use the names of boys in the group) like to play dodge ball.
   c. Hurricane Betsy caused a lot of damage in Florida. It also caused a lot of damage in Louisiana. The wind and floods ruined people's homes.

SUMMARY: Distinguish between a generalization and a specific statement of fact. Caution children that an accurate generalization must be based on the facts given. Later they will examine generalizations more carefully to see when the statement is based on adequate amounts of fact and when the statement is based on a representative number of cases. These are called "hasty generalizations" and "unrepresentative generalizations." At this point, recognition of a generalization is adequate.

A worksheet was included for this lesson.

Card-stacking Grades 4-5-6

PURPOSE: To help students recognize some of the common fallacies used in writing; specifically card-stacking or omission of data.

MATERIALS: Attached work sheet and pages 6, 7, 8, 9, 10, and 11 in the Logic flip chart.
Advertisements.
Samples from political speeches.

PROCEDURE:

1. Show samples of card-stacking in the collection of advertisements attached. Call particular attention to the surveys done in which three out of four say such and such, or 50 percent more effective than something. In the ads which show what a low rate of interest is charged, have them figure it out to really see how much they would have to pay to borrow money or buy insurance.

2. When graphs or charts are used, ask the students what the units of measurement on the charts or graphs represent. (e.g., the cough medicine ad has units up to 30; does this mean that you take more of the cough medicine or did they compare their medicine with the leading pancake syrup?)

3. Some of the ads for weight control tell how much lighter you will look in ten days.

4. Draw out during the lesson that card-stacking is a device in which only part of the story is told. Statistics may be used to support the particular point of view that the author is trying to present.

5. Read the samples on the attached worksheet to determine what part of the story is told and what else should be known.

6. Have the students collect samples of ads and writing selections that employ telling only part of the picture.

7. Use the attached worksheet for recognition of card-stacking techniques.

SUMMARY: Point out that propaganda devices are not "good" or "bad" in themselves, but that the critical reader must always look beyond what is told and ask, "What else do I need to know?" before he can make up his mind about this.

CRITICAL READING GROUP

Components of Literature

Background for the Teacher

The unit on Components of Literature has as its major purpose the literary analysis of books. Generally, the lessons are intended to help students look at characterization, plot structure, theme, and setting.

The lessons on characterization are intended to help children distinguish "flat" or stereotyped characterization from well developed, believable characters. Characterization is one of the most important components of good literature and perhaps should be given more time than other components. Hook's* analysis of methods of characterization may be helpful, but at this point the major purpose is evaluation of how well the author has done in producing a believable character.

The lessons on plot structure are intended to help students recognize why an author puts a story together as he does. Climax, sub-climax, anti-climax, repetition, high points of action, are used to build a framework for a story. When stories are pictured graphically in some of the lessons, the peaks are the high points in the action and the base line represents the continuation of the story. The smaller peaks represent the building action in a story and usually precede the highest peak which represents the climax of the story. Although this phase of literary analysis can be overdone just as diagramming sentences can be, it is a device used to show children how the pieces of a story fit together. Picturing elements of plot in this manner may be helpful for children in writing their own stories. We should try to help students see that stories which have high peaks of action are more interesting than ones which proceed "and then . . . and then . . . and then."

In these lessons an attempt has been made to call attention to the importance story setting may play in children's literature. When the reader knows the time and place of a story, he may to some extent predict what events will take place. He may even predict what a person will do, for he realizes that people are influenced by the circumstances in which they find themselves. "Why does the character think and act and talk the way he does in the story?" and "Would the character have acted differently under different circumstances?" are questions which the critical reader should ask. Such questions may seek to determine how the setting affected the action and the character development of the story.

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*J. N. Hook, Writing Creatively (D. C. Heath and Co., 1963), pp. 137-156.

In nearly all good literature, the author has some basic message or idea that he wants to get across. This underlying message is called the theme, and the author really uses the plot or story to carry the theme. Children need to be taught to separate the theme from the plot and to state the theme. However, children should be allowed to make their own individual interpretation of the theme. For example, the theme in Cabin Faced West has been said to be, "Good things come to those who wait," "Hope springs eternal," "Home is where the heart is," "The past is remembered favorably."

The theme in a fable is made rather explicit by the moral. The theme in a biography generally represents the particular point of view or character traits which the biographer wants to emphasize. No biographer can tell all of the incidents of a man's life, so he selects those which fit his understanding and image of the man. Frequently juvenile biographies give a clue to the author's point of view in their titles, such as Thomas Jefferson, Champion of the People by Clara Ingram Judson, or Retreat To Glory, The Story of Sam Houston by Jean Lee Latham.

Many stories have similar themes which are interesting to compare, yet the plot is entirely different. (Petunia, Harry, the Dirty Dog, Little Rabbit Who Wanted Red Wings, Dandelion, The Unhappy Hippopotamus)

Compare and Contrast — Grades 1-3

PURPOSE: To compare and contrast themes in fairy tales.

MATERIALS: Andersen, Hans Christian. The Emperor's New Clothes. Illustrated by Virginia Lee Burton. Boston: Houghton Mifflin, 1949.

Freeman, Godfrey. The Owl and the Mirror New York: Duell, Sloan and Pearce, 1960, pp. 38-44.

Shane, Harold, and Kathleen Hester. Doorways to Adventure. River Forest, Illinois: Laidlaw Bros., 1961, pp. 93-99.

Andersen, Hans Christian. The Emperor's New Clothes. Translated and illustrated by Erik Blegvad. New York: Harcourt, Brace and Co., 1959.

Two excerpts about the stories.

PROCEDURE:

1. Read at least one version of each of the above stories prior to the discussion suggested here.

2. Review the main events of each story.

SUGGESTED QUESTIONS:

a. What things are alike in "Master Till Painted a Picture" and The Emperor's New Clothes?
b. What things are different in the two stories?
c. What is the theme in each story?
d. Who caused the farce to be exposed in each story?
e. What does Till show us about ourselves?
f. Do you know any other stories with a similar theme?

SUMMARY: Summarize the main points of similarity and difference found in the stories. Show the students the process they have been using; i.e., comparing and contrasting story themes.

Theme — Grades 5-6

PURPOSE: To help children to identify the story theme and to begin to understand its significance in literature.

MATERIALS: Gates, Doris. Blue Willow. New York: The Viking Press, 1940.

PROCEDURE:

1. Have the children read the book (or hear it read) prior to the discussion.

2. Let the children briefly review the plot of the story.

3. Discuss the story with special focus on the book's theme.

SUGGESTED QUESTIONS:

a. What kind of people are the Larkins? Does any of their earlier background "show through" in their lives as itinerant farmers?
b. How does Janey show a sense of family loyalty on several occasions?
c. Do Janey's father and step-mother ever show special consideration for her?
d. Why do you think Janey considered it "just as well not to get too thick with strangers" and why did Mom advise: "Mind your own business and the other fellow won't have to mind it for you?" What do these quotes tell you about the Larkins' relationships beyond the family?
e. What is Janey's biggest desire? Does she knowingly do anything to make it become a reality?

f. How much of the story's action is due to Janey's initiative?
g. Who is the most responsible for the story's happy ending?
h. Can you see any meaning behind this story? What do you think the author wanted to tell the reader? Could she have given the message by means of a different story?

SUMMARY: List several versions of the theme on the board as the children suggest them. Help the children to see that they have attempted to draw from the story its main idea. Be sure they understand that the theme and the plot of a story are different but closely related.

PART II

ILLUSTRATIVE LESSON PLANS FOR CONTROL GROUP

(Children's Literature)

CHILDREN'S LITERATURE GROUP

Understanding the Past

Background for the Teacher

Although some educators desire that the formal study of history be postponed beyond the elementary school years, they agree that some early contacts with the past are both good and necessary for young pupils. Children's books can provide this contact in a way that makes history meaningful.

The books which have been selected for this unit on Understanding the Past are predominantly works of historical fiction and fictional biography. The selections for which lesson plans have been made are merely suggestive of the kinds of books which can help children use the lessons of the past in planning for the future.

Great numbers of factual books for children are being printed today. The range of subjects becomes ever wider as man continues to make astounding discoveries about things both near and far away. Factual historical books have earned a place in this list.

Van Loon's* The Story of Mankind (1921) first interpreted world history to children in an interesting and informational fashion. Since that time other writers have followed this pattern, and books of history for children have become numerous. In helping children understand their historical heritage, the best of the factual books should not be ignored. Huck and Young comment on a variety of such books in Children's Literature in the Elementary School.** The teacher is encouraged to peruse these pages and use some of the suggested books for class enrichment.

Historical Perspective. The books which have been selected for this unit are ones which, for the most part, children want to read--because the stories are good and the characters interesting. The historical dimension adds to the color and excitement of the story, but it may fade into the background for the reader as he becomes absorbed in the story plot. Discussions following the reading of these books may be purposely directed to bringing historical perspective into focus. That is the purpose of the first group of lesson plans presented here.

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*Hendrik Van Loon, The Story of Mankind (Liveright Publishing Corp., 1921; new enlarged edition, 1951).

**Charlotte S. Huck and Doris Young, Children's Literature in the Elementary School (New York: Holt, Rinehart & Winston, Inc., 1961), pp. 195-205.

First and second graders can be introduced to a feeling for history by means of The Sky Was Blue. For a child of six, the time when mother was a little girl is far away indeed. "What was it like?" and "How did you feel?" are realistic questions. As the child goes back two generations further with her mother's guidance, she begins to understand that little girls in those "far away days" experienced many of the same feelings and joys as boys and girls today.

Children a bit older may increase their understanding of history by learning about some of America's heroes. A discussion of the d'Aulaires' book, Abraham Lincoln, might help these children to gain some insight into a period which is quite remote from their experience. It is the purpose of the suggested lesson to foster initial insight into a total view of life at the time Lincoln lived. The pictures should be helpful in attaining this objective.

Big Tree is suggested for fifth and sixth graders to help clarify the concept of the passage of a great number of years. The giant redwoods of California are known to most pupils of this age level, either through the personal experience of seeing them or through pictures and other information about them. The life of the tree gives some unity to the 5,000 years which are seen in panoramic view in this book.

Some teachers may prefer to conduct a similar class discussion using Holling C. Holling's Tree in the Trail. In this book the Sante Fe Trail is described through the life of a cottonwood tree. The tree lived from 1610 until it was struck by lightning in 1834. Because the period of time covered in this book is much shorter than that in Big Tree, this selection may be used as a prelude to that lesson.

Using Biography. Elementary school children are becoming avid readers of biography, and their demands are being met by an ever-greater supply of such books. Authors frequently spend great lengths of time in research before applying their skill of writing. The characters step forth in these books as real people, appealing precisely because they are so genuine. Thus the d'Aulaires say of Lincoln:

> . . . The more we studied Lincoln, the closer he came to us, the greater he became, the more necessary to our present life, the closer related to us and our times. At last he was not an historical person any more, but a warm and kind and generous relative who had moved into our studio with us. We became more and more convinced that if only we could give to our young readers a bit of the feeling about Abraham Lincoln we had perhaps done our tiny share to make the world a happier place, when those who are now children have grown up to run the world. . .
>
> (Ingri and Edgar d'Aulaire. Acceptance paper when receiving Caldecott Award, 1940.)

This life of Lincoln was used earlier in the unit to help children attain a sense of historical perspective. The second suggested plan is focused more on the characteristics of the man. The illustrations tell as much about Lincoln as the text; the teacher should give attention to both.

The picture biography of Columbus, The Columbus Story, is an authentic and interesting story for first and second graders. Leo Politi's illustrations will probably be the first and most lasting attraction for the young audience. The teacher should be able to lead the children to a deeper understanding of both history and biography by means of them. More than one lesson will be needed if both the pictures and the text are to yield their potential. Art work, creative writing, and creative dramatics are a few of the means by which the ideas introduced in the lessons can be extended.

The final lessons in this unit concern a less well-known figure than Lincoln or Columbus. Elizabeth Yates uncovered and organized all the information available concerning a Negro slave whose life covered the years from 1810 to 1901. The writer then set her imagination to work to supply the missing details and to produce the book: Amos Fortune, Free Man. The slave's search for freedom is vividly re-created for the young reader. A message is there which goes beyond the biography, for what Amos Fortune stood for in his day is vital to our own. It's this type of an understanding of history that elementary school children can gain from the best of children's books.

Historical Perspective — Grades 3-4

PURPOSE: To help children gain some sense of historical perspective by seeing Abraham Lincoln's life within the framework of a period of U. S. history.

MATERIALS: d'Aulaire, Ingri and Edgar Parin. Abraham Lincoln. Garden City, New York: Doubleday & Company, Inc., 1939, 1957.

PROCEDURE:

1. Read the book aloud to the children or have them read it individually. Be sure that they see the illustrations.

2. Point out that American history is closely tied to the lives of great men and that a biography of Lincoln gives a good introduction to a period of U. S. history.

3. Discuss the book with particular references to the general history of the times. Use the endpapers of the book or a large wall map to follow Lincoln in his travels from Kentucky to Washington.

SUGGESTED QUESTIONS:

a. In what kind of a house was Lincoln born? How did it compare with other Kentucky homes of the time?
b. What kind of school did Abe attend?
c. Abe's mother died when he was nine. Why did so many people die at a young age in the wilderness?
d. What was one of Abe's favorite pastimes?
e. What did Abe do when he settled in New Salem, Illinois?
f. What was the big quarrel between the North and the South during Lincoln's time?
g. What did Lincoln do for the slaves?
h. What would you say was the greatest thing Lincoln did for his country?

SUMMARY: Let the children discuss briefly why Abraham Lincoln is honored as one of the greatest men in American history and what challenges of the time helped to make him great.

Medieval History — Grades 5-6

PURPOSE: To learn about life in England during the Middle Ages as it is portrayed in The Door in the Wall.

MATERIALS: DeAngeli, Marguerite. The Door in the Wall. Garden City, New York: Doubleday and Company, Inc., 1949.

PROCEDURE:

1. Read the book aloud or have the children read it individually.

2. Discuss the time and place of the story. Locate London on a map. Note what years make up the fourteenth century.

3. Discuss the book, focusing on historical details.

SUGGESTED QUESTIONS:

a. Why was Robin supposed to go to the castle of Peter de Lindsay? What is a Page? What would Robin eventually become?
b. What did you learn about a medieval town from the story? What is a curfew? Why did the church bell sound the curfew?

c. What was St. Mark's hospice like? Why was it so crowded with people at the time of the story? Do you think monasteries today are like this one?
d. How is Robin's letter to his father different from one you might write to your father? Did the fact that Robin was the son of a knight have any bearing on his relationship with his father? With his mother?
e. Are there times in the story when Robin shows that he is aware of his class superiority? Would you expect his attitude to be different from that of a boy who grew up in a democracy?
f. Did Robin's nobility carry with it any obligations? Did he live up to them?
g. Did Robin receive a fitting reward for saving the Lindsay castle? How was John-go-in-the Wynd rewarded for his part in the deed? Was the reward suited to his social position?
h. What did you notice about the style of language used in the story? What did you learn about the characters' names? Can you now understand how some modern names came into existence?

SUMMARY: Let the children compare life in the Middle Ages with life today, pointing out the advantages and disadvantages inherent in each period.

CHILDREN'S LITERATURE GROUP

Mathematics

Background for the Teacher

Mathematics programs seem to be moving ahead with great strides today. Mathematicians are helping to keep the subject matter up-to-date in the schools, and educators at all levels are concerned with improving methodology. The danger in it all is that the child may be forgotten. Some fear that those responsible for the program may forget what it means to be childlike, how children think, and what their interests are.

The purpose of this unit is to help children become acquainted with books which will help to enrich and enliven mathematical concepts. Some of the books suggested do capture the spirit of children; and while they have quantitative or spacial implications, they allow the child to be himself -- to be childlike.

Some of the "new math" programs have as a goal to encourage children "to think like mathematicians." If by this is meant that the pupil should express his curiosity in novel ways and stretch his imagination beyond that possible in ordinary school routine, it can be a valuable objective. These colorful dimensions can be added to the math program by means of a variety of children's books. The imaginative use of such material presents a challenge to the elementary school teacher, but it is a challenge which can be rewarding to the teacher and pupils alike. In the desire for excellence, the child will be kept in focus.

The series of lessons on maps could appropriately be included in a unit on geography or social studies. They are used here to help students see the practical applications of drawing to scale. Maps are graphic representations of parts of the earth or of the entire earth. Children can understand simple reduction in size but have difficulty in visualizing the true area represented by the map. The abstraction of the map must be related to the reality being represented. In order to do this, students need to learn scaling and its application.

Biographies of Mathematicians, Grades 5-6

Because of the desire for action on the part of young readers, few authors have attempted to write of the lives of the less-colorful heroes of the ages. Some of the now famous mathematicians spent years

in the slow process of laying the groundwork for their major discoveries. Often they sought to disprove accepted theories and so experienced conflict with authority. All of this made for a degree of unpleasantness and so was not considered to be subject-matter for children's biography.

Within recent years some biographies of mathematicians have appeared. A few of them are annotated here. Some advanced readers might enjoy them although their story appeal is limited for elementary school children.

Beckhard, Arthur. Albert Einstein. New York: G. P. Putnam's Sons, 1959.
The threat of persecution hovered over Albert Einstein during his whole lifetime because of his Jewish ancestry, yet he wished to provoke no antagonism in turn. Because his ideals were those of a pacifist, he dreaded the application of his famous atomic energy formula to implements of war. Only when he knew that the Germans also had the secret did he consent to allow the atomic bomb to be constructed. This book portrays a man of courage and integrity desirous of making the world a better place for future generations.

Tannenbaum, Beulah and Stillman, Myra. Isaac Newton, Pioneer of Space Mathematics. New York: Whittlesey House, McGraw-Hill Book Company, Inc., 1959.
The genius of this mathematician becomes evident to the reader early in the book, even though the servants of the Newton household found him unreliable about the farm and so "fitten only for the 'Versity." Although Isaac Newton attained much fame in his lifetime, he gave up much for it, including the girl who once desired to be his wife. Throughout the book, the explanations concerning his work are often technical, but students interested in watching a scholar at work may appreciate the details. Careful research seems to underlie this biography of a "man of thought."

Jonas, Arthur. Archimedes and His Wonderful Discoveries. Englewood Cliffs, New Jersey: Prentice-Hall, 1963.
This book tells of both the life and the major discoveries of a genius of ancient Greece. A giant both as a scientist and a mathematician, Archimedes discovered the principles underlying the lever and other simple machines, the laws of displacement and floating bodies, and numerous other mathematical concepts. The book is easier to read than those mentioned above, and the pictures by Aliki add a note of humor.

History of our Number System — Grades 3-4

PURPOSE: To encourage an on-going interest in the lessons in this unit by developing a mural showing the development of our number system.

MATERIALS: The children may use any appropriate references. A number of books give relevant historical information, but one which is written particularly for these grade levels is:

Carona, Philip. The True Book of Numbers. Chicago: Children's Press, 1964.

PROCEDURE:

1. If possible, the book listed above and others showing the history of numbers should be made available to the pupils prior to the period for planning the mural.

2. The pupils should be helped to gain a clear idea of what they want to portray and how they can best work together to do it.

3. The entire project may be carried out in a number of ways. A small group of children may be engaged in the activity while the majority of the class members work at other things. With The True Book of Numbers as a guide, the mural may be completed with only a minimum of time expenditure. The "story in pictures" should be kept simple if it is to be a profitable learning experience for children of this age level.

SUMMARY: Regardless of the manner or method of construction, the visual aid should help the children to gain some appreciation of the development of our number system. The teacher should help the children to see that each step in the evolving process was a necessary one. Without the constant experimentation of others through the ages, we would not have our number system as we know it today.

Uses of Computers — Grades 5-6

PURPOSE: To provide enrichment for the "new math" program by helping children to understand a practical application for the binary number system.

MATERIALS: Kohn, Bernice. Computers at Your Service. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962.

Jonas, Arthur. New Ways in Math. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962, Chapters 3, 4, 5.

Any other books which contain material on the binary number system or the use of computers.

PROCEDURE:

1. Prior to this lesson, explain the binary number system to the class. Chapter 2, "Simple Arithmetic" in Computers at Your Service and Chapter 4, "The Magic of Two" in New Ways in Math present the material in an interesting way, but most students at this level will need some teacher direction in order to get some understanding of the system. It is not necessary that every child attain a clear understanding of it; some children will have to live with the base idea for a long time before they understand it.

2. Make as many as possible of the above-mentioned types of resources available. Since information on this topic for these grade levels is limited, it would perhaps be best if only a part of the class prepared for the discussion.

3. Suggested questions for the lesson on computers:

   a. What number system is used with most computers? Why is the binary system preferred?
   b. What are some of the modern uses for computers? Ask students to first give large agencies and then fill in the specific uses. The list may be made on a chart or the chalk board. Perhaps the headings will be:

Space Program	Armed Forces	Government	Business & Industry	Miscellaneous

   c. What kind of experimental programs are now being developed? Can you think of other uses for the computer? (School uses?)
   d. With such machines to do the work, why is there so much concern today about educating mathematicians?
   e. What is the major advantage of the computer? (Speed)

SUMMARY: Recall with the children the answer which probably followed the question (d) above: Men think. Machines do. Machines can only do what men tell them to. In the future, many people will have to understand the general theory of the computer, for there is every likelihood that computers will come to be used in the everyday lives of millions of people.

APPENDIX D

SAMPLE TEST ITEMS

PRIMARY TEST OF CRITICAL READING

Sample Test Items on Logic

1. Unrepresentative Generalization

a) Nancy said, "Boys are awful. I asked every girl in my class and everybody said they were. I think our teacher should tell boys that they can't come to school."

What would have been the most correct thing for Nancy to say?

(1) Every girl in the world thinks boys are awful.
(2) All of the girls in my class think boys are awful.
(3) Boys are awful because all the girls in my class said so.
(4) Everybody knows that girls think boys are awful.

2. Hidden Assumption

b) John knows how to read. He must be smart.

If these sentences are true, what else must be true?

(1) All children who can read must be smart.
(2) Some children who can read must be smart.
(3) Many children who can read must be smart.
(4) Most children who can read must be smart.

Sample Test Items on General Skills

1. Comparison of Information from Different Sources

The First Story	The Second Story
The little deer stood still as the lion walked through the forest. The color of the deer's fur was the same as the color of many of the fall leaves. The lion did not see the deer.	During a war, men paint their clothes and tank with many colored spots. They use colors that look like the trees, ground, and sky. The enemy cannot see the men in the forest.

a) In what way are these two stories alike?

(1) They tell how colors can protect you.
(2) They tell about men who paint their clothes.
(3) They tell about a lion and a deer.
(4) They tell about a walk in the forest.

b) In what way are these stories different?

(1) One is about clothes and the other is about leaves.
(2) One is about colors, the other is about leaves.
(3) One is about animals, the other is about trees, ground, and sky.
(4) One is about animals and the other is about men.

2. Semantics: Vague or Precise Words

c) Mary said, "That little girl is poor."

What does the word poor mean here?

(1) That the little girl has no money.
(2) That the little girl's father has no money.
(3) That the little girl wears old clothes.
(4) It is hard to tell what it means.

Sample Test Items on Literature

1. Analysis of Figurative Language and Personification

White Snow, Bright Snow

In the morning a clear blue sky was overhead and blue shadows hid in all the corners. Cars looked like big fat raisins hidden in the snow. Houses sat close together, their windows peeking out from under great white eyebrows. Even the church steeple wore a pointed cap on its top.

a) What do the words "The church steeple wore a pointed cap on its top" mean?

(1) The snow looked funny on the church steeple.
(2) The snow on the steeple looked like a pointed cap.
(3) The steeple had a pointed top.
(4) The steeple was piled high with snow.

b) How are the last two sentences in the story alike?

(1) Both tell about buildings as if they were persons.
(2) Both tell how the church and houses looked the same after the snowstorm.
(3) Both tell about the buildings on a cloudy day.
(4) Both tell about the buildings at night.

c) What do the words "Cars looked like big fat raisins hidden in the snow" mean?

(1) That the cars looked good enough to eat.
(2) That the cars looked tiny when they were covered with snow.
(3) That the snow made the cars look brown.
(4) That the snow made the cars look like fat raisins.

INTERMEDIATE TEST OF CRITICAL READING

Sample Test Items on Logic

1. Drawing a Conclusion from Syllogism

   a) Anyone who has the interest of the United States at heart will fight against Communism. Senator Smith has the interest of the United States at heart.

   If the above statements are true, what conclusion must be drawn?

   (1) Anyone in the United States might fight against Communism.
   (2) Anyone in the United States will fight against Communism.
   (3) Senator Smith might fight against Communism.
   (4) Senator Smith will fight against Communism.

2. Composition and Division: What Holds True for the Group, Holds True for Each Member of the Group

   b) The principal of State Street Elementary decided that the Tiger Club would have to disband. "It is not a good club," he said. "The club is not fair in selecting its members." John and Bill were members of the Tiger Club, so many children decided that John and Bill were unfair.

   Were the children correct?

   (1) No, John and Bill were probably nice boys who were forced to join the club.
   (2) No, just because the club as a whole was unfair doesn't mean each member was.
   (3) Yes, John and Bill wouldn't have been in the club if they were not unfair.
   (4) Yes, if the club was unfair, then all its members must have been unfair.

Sample Test Items on General Skills

1. Comparison of Information from Different Sources

The Bat Poet

Once upon a time there was a little light brown bat, the color of coffee with cream in it. He looked like a furry mouse with wings. When I'd go in and out my front door, in the daytime, I'd look up over my head and see him hanging upside down from the roof of the porch. He and the others hung there in a bunch all snuggled together with their wings folded, fast asleep. One little brown bat said, "Don't go away. I'll be homesick."

Winter-Sleeping Wildlife

One of North America's hibernating mammals is most unusual. This unique hibernator, a bat, is the only mammal of the world's 2,000 mammals that can fly. North America has many of the world's known and named bats. One type is called the little brown bat. Usually the little brown bat selects a cave in which to pass the winter. He hangs upside down by one foot, then another, or perhaps all four to sleep during the day.

a) In what way are the stories alike?

(1) They both tell that bats hibernate.
(2) They both describe bats that talk.
(3) They both tell how the bats sleep.
(4) They both say that bats are mammals.

2. Selecting Appropriate Source

b) If you wanted to know to what class of animals a bat belongs, which sentence would you select?

(1) The unique hibernator is a bat.
(2) One of North America's hibernators is a bat.
(3) He looked like a furry mouse with wings.
(4) The bat is the only mammal that can fly.

c) Both of the stories are about bats. What sources would you use if you were making a report to a science class?

(1) The second story.
(2) The first story and part of the second.
(3) Both of the stories.
(4) Parts of each story.

Sample Test Items on Literature

1. Identifying Literary Form and Theme

"The Dog in the Manger"

A Dog jumped into the manger of an Ox to take an afternoon nap. It lay sleeping on the straw when the Ox returned from its work. The Ox came up to the manger and wanted to eat some of the straw.

The Dog was in a rage at being wakened from its nap. It stood up and barked at the Ox. Whenever the Ox came near, the Dog tried to bite it.

At last the Ox gave up hope of getting the straw.

a) What kind of story is this?

(1) A folk tale
(2) A fable
(3) A fairy tale
(4) A myth

b) What could the moral of this story be?

(1) Be kind to one another.
(2) Let a sleeping dog lie.
(3) Some do not want others to have what they themselves cannot enjoy.
(4) Don't bite the hand that feeds you.

APPENDIX E

DIRECTIONS FOR USING REVISED OBSERVATION SCALE

DIRECTIONS FOR USING REVISED OBSERVATION SCALE

Only verbal behavior will be observed and recorded. Verbal behavior of teachers will be recorded on the rows and verbal behavior of pupils will be recorded in the columns. The unit of verbal behavior to be categorized is a "thought unit" defined as a remark or series of remarks which express a complete idea, or serve a specific function. Generally, it will be all words spoken by one person at one time. If the speaker makes a transition from one category to another while speaking a new UVB is indicated and observers will record it in the appropriate category. Thus, the unit of verbal behavior may be one word or several sentences. Each unit of verbal behavior (UVB) is given a number in the sequence that it occurs; 1, 2, 3, 4, 5, in the appropriate category. Pupil responses to a teacher's question are given the same number as the teacher's question in order to preserve the relationship between the teacher comment and the pupil response. When one teacher question or comment elicits a series of pupil responses, they are listed as (1), (1a), (1b), (1c), (1d), on the same row as the teacher's question or comment. If the verbal behavior of the teacher requires a change of categories, pupil responses follow. Pupil responses are recorded on the same row as the teacher's comment at the pupil response level indicated.

The completion of a UVB is <u>not</u> determined by its length but according to its content. A new number is recorded every time a transition to a new category is made. For instance, if the speaker gives information, then adds an evaluative statement, a number is recorded in each category. The observer should be cautioned that he cannot rate verbal behavior apart from the context of the lesson.

All unrelated comments, such as parroting children's responses, and general confusion will be ignored as a part of verbal behavior. Recorders will always rate the main speaker but if the observer cannot identify any one person as the main speaker it will be considered confusion. Group reaction will be recorded as the number plus a (g) and categorized at the pupil response level indicated by the context of the discussion.

Pupil-initiated remarks are indicated by a new number followed by "pi." A pupil-initiated remark is categorized on the same row as the teacher comment that preceded it unless it obviously belongs in another teacher category. Teacher responses or other students' responses to pupil-initiated questions or statements are entered as chained responses to the pupil-initiated remark as described in the preceding paragraphs, i.e., 3 pi., for the pupil-initiated remark, then in the appropriate teacher category (3a). If other pupils respond to a pupil-initiated remark, these responses are recorded in the same manner (3a, 3b) in the appropriate column of pupil responses.

Teacher Verbal Behavior

There are seven categories for teacher behavior; gathering facts, clarifying, interpreting or inferring, analyzing, applying, summarizing, and evaluating. A category called "controlling" was provided for comments of this nature and a category called "other" was provided for statements inappropriate any place else. These were not used.

Statements and Questions

Each of the teacher categories is sub-divided into statements and questions. The teacher may be gathering specific facts by giving them to the students in a lecture or by asking questions of the students which will bring specific facts before the group. When the teacher is reading to the students, showing audio-visual materials, or using a resource person to present information, a number is recorded under giving statements in the gathering specific facts category.

Teacher Categories
(To be Recorded on the Rows)

Gathering Specific Facts

All teacher talk that is intended to bring information to the attention of the group is recorded as gathering specific facts. It includes fact stating, reporting information from books and authorities, getting the main idea, reading from a book, or requesting information from pupils. When audio-visual materials or resource people are used to present information, this will also be recorded as giving specific facts.

Examples: What is the author saying?
What is the advertisement telling you?
Read the part that tells what he did.

Clarifying

A clarifying statement or question is one used to refine previously discussed ideas or those misinterpreted by members of the group. It includes defining, clarifying a concept through an illustration, emphasizing a prior point, rephrasing, or making the meaning clear. Parroting statements are ignored unless an idea is expanded.

Examples: Do you mean this? Why do you say that?
Could you say it another way?
Tell us more about that.

Interpreting and Inferring

An interpreting or inferring statement or question is one which goes beyond the literal meaning. It includes interpreting figurative language, inferring beyond the literal message, translating information into more comprehensible language, and extrapolating beyond the available data.

Examples: What kind of person do you think he is?
What is the author implying?
What group of people would be interested in an article like this?
What does the advertiser want you to think?

Analyzing

An analyzing statement or question is intended to separate or distinguish component parts of a situation, a piece of writing, or a phrase. It includes examining the nature and relationship of the parts, searching for the organizational pattern or principles, or determining the internal consistency of a piece of writing or an argument.

Examples: What are the premises that the author is presenting?
Are there some unstated assumptions here?
Does the conclusion necessarily follow?
Is this the only conclusion that could be drawn from these statements?
How could we break this argument down into the basic elements?
How do you know there is a moral in the story?
Does this story follow the form of a fable?
How is this news story put together?

Applying

An applying statement or question is one in which the teacher makes or asks a student to make some direct application of information or criteria related to the lesson. It includes applying information to illustrate a point, applying criteria to be used in evaluation, and illustrating a generalization or a principle in a specific instance.

Examples: Is this a faulty generalization?

According to our time line, into what period does this event fall?
Would this criteria apply to the material here?
Illustrate from the list of techniques for developing characters the way this author develops the character in this story.

Summarizing and Concluding

A summarizing statement or question synthesizes several preceding statements of fact and may show the relationship among several of those statements. It includes a summary; resume of events or an integration of several pieces of information.

Examples: What can you conclude?
What were the most important parts of what we learned?
What did we find out about this?
What were the main things that happened?
How do the parts of this story fit together?
If you had to use one word to tell about this story, which would you use?

Evaluating

An evaluative statement or question is one in which a judgment is made based upon established criteria. It includes personal interpretation or judgments about the quality or accuracy of printed material. Judgments are made about the veracity, accuracy, or validity of data being considered and must be supported with evidence for that position. An evaluating question is one which elicits a decided judgment based upon previously established criteria. A child may use his own set of personal values as the set of criteria or use criteria established by the group.

Examples: This article is well written because it meets these standards of writing.
Do you agree with John?
Why do you think it is well written?
Are you going to accept his conclusion?
What are your reasons for your decision?
What evidence do you have for saying it is valid or invalid?

Pupil Responses
(To be Recorded in the Columns)

A student response is classified as critical or non-critical not on the basis of the correctness of the content of the response but on the basis of the reasoning involved.

Level 1: Random Response

When there is unsupported guessing in response to a teacher's comment or question, a number is recorded in this column. If a child says "I don't know," it is recorded here. "I like," "I don't like" statements are considered random responses unless they are justified by further verification or show the use of data to make a decision, whereupon they become critical.

Level 2: Non-Critical - Literal

Non-critical responses are those which can be directly drawn from the material in the lesson. They will include factual answers, literal comprehension, reporting verbatim, and repeating previously agreed upon material.

Level 3: Giving Illustrations, Applying, Interpreting

Responses in which children give illustrations, interpret material, or apply information are recorded at Level 3. These responses are frequently those in which a child gives an example from his own life which exemplifies the point under discussion.

Level 4: Imagining, Hypothesizing, Theorizing

Pupil responses which go beyond the information available to the group are recorded in this category. They include going beyond the data, extrapolating, or diverging from the material before the group.

Level 5: Critical Thinking: Evaluating, Judging, Using Criteria

Responses recorded at Level 5 are ones in which students go beyond the literal meaning of printed matter, use data in an evaluative decision,

make a judgment about the accuracy or quality of writing, see deeper meanings in the material, or recognize the fallibility of printed materials. Judgments must be supported with evidence and evaluations must be based upon established criteria. They include recognizing the omission of necessary data, distinguishing fact from opinion, and selecting and using relevant data in evaluative decisions.

	Gives Statement	Asks Questions	LEVEL 1 Unsupported Guessing Random Response	LEVEL 2 Literal Recall Memory Cognition	LEVEL 3 Making Inferences Giving Illustration Applying Information Interpreting Convergent	LEVEL 4 Theorizing Hypothesizing Divergent	LEVEL 5 Evaluating Judging Giving Support for Stand Using Criteria
Gathering Specific Facts							
Clarifying							
Interpreting Inferring From Facts							
Analyzing							
Applying							
Summarizing Concluding							
Evaluating							

APPENDIX F

ADDITIONAL TABLES OF RESULTS

TABLE 4a[1]

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE ONE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 28 Control		N = 24 Experimental		N = 22 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
11.27	15.73	15.07	20.39	14.83	24.92	11.23	14.18

TABLE 4b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE ONE

	Pretest	Posttest	Gain
R_1	13.24	18.15	4.91
R_2	13.13	19.78	6.65
T_1	12.98	20.14	7.16
T_2	13.38	17.66	4.28

TABLE 5a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE ONE

Source	df	SS	MS	F
Replication	1	64.15	64.15	2.65
Treatment	1	185.39	185.39	7.66**
Rep. by Treat.	1	622.98	622.98	25.75**
Within	95	2,298.22	24.19	
Total	98	3,170.74		

**Significant at the .01 level

[1]In order to aid the reader, the detailed tables presented in Appendix F have numbers corresponding to their summary tables in Chapter IV.

TABLE 4c

MEAN SCORES ON LOGIC SUB-TEST
GRADE ONE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 28 Control		N = 24 Experimental		N = 22 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.54	6.77	7.07	7.29	4.88	10.67	4.64	5.64

TABLE 4d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE ONE

	Pretest	Posttest	Gain
R_1	5.85	7.04	1.19
R_2	4.76	8.26	3.50
T_1	4.70	8.64	3.94
T_2	6.00	6.56	.56

TABLE 5b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE ONE

Source	df	SS	MS	F
Replication	1	48.19	48.19	6.91**
Treatment	1	136.81	136.81	19.61**
Rep. by Treat.	1	127.51	127.51	18.28**
Within	95	662.81	6.98	
Total	98	975.32		

**Significant at the .01 level

TABLE 4e

MEAN SCORES ON GENERAL SUB-TEST
GRADE ONE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 28 Control		N = 24 Experimental		N = 22 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
2.81	3.46	3.25	5.32	3.71	4.25	2.50	3.45

TABLE 4f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE ONE

	Pretest	Posttest	Gain
R_1	3.04	4.43	1.39
R_2	3.13	3.87	.74
T_1	3.24	3.84	.60
T_2	2.92	4.50	1.58

TABLE 5c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE ONE

Source	df	SS	MS	F
Replication	1	7.61	7.61	1.97
Treatment	1	14.07	14.07	3.63
Rep. by Treat.	1	27.50	27.50	7.10**
Within	95	367.74	3.87	
Total	98	416.92		

**Significant at the .01 level

TABLE 4g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE ONE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 28 Control		N = 24 Experimental		N = 22 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
3.92	5.50	4.75	7.79	6.25	10.00	4.09	5.09

TABLE 4h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE ONE

	Pretest	Posttest	Gain
R_1	4.35	6.69	2.34
R_2	5.22	7.65	2.43
T_1	5.04	7.66	2.62
T_2	4.46	6.60	2.14

TABLE 5d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE ONE

Source	df	SS	MS	F
Replication	1	7.08	7.08	1.55
Treatment	1	15.62	15.62	3.42
Rep. by Treat.	1	189.49	189.49	41.43**
Within	95	434.50	4.57	
Total	98	646.69		

**Significant at the .01 level

TABLE 4i

MEAN SCORES ON READING TEST TOTAL
GRADE ONE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 28 Control		N = 24 Experimental		N = 22 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
50.19	62.23	49.36	67.64	54.17	81.00	26.14	42.86

TABLE 4j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE ONE

	Pretest	Posttest	Gain
R_1	49.76	65.04	15.28
R_2	40.76	62.76	22.00
T_1	52.10	71.24	19.14
T_2	39.14	56.74	17.60

TABLE 5e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE ONE

Source	df	SS	MS	F
Replication	1	528.47	528.47	8.74**
Treatment	1	229.61	229.61	3.80
Rep. by Treat.	1	1,805.48	1,805.48	29.86**
Within	95	5,744.01	60.46	
Total	98	8,307.57		

**Significant at the .01 level

TABLE 6a

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE TWO

Replication 1 (R_1)				Replication 2 (R_2)			
N = 21 Experimental		N = 29 Control		N = 26 Experimental		N = 34 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
19.52	25.38	14.07	21.10	14.50	24.23	16.56	22.91

TABLE 6b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE TWO

	Pretest	Posttest	Gain
R_1	16.36	22.90	6.54
R_2	15.67	23.48	7.81
T_1	16.75	24.74	7.99
T_2	15.41	22.08	6.67

TABLE 7a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE TWO

Source	df	SS	MS	F
Replication	1	24.38	24.38	.92
Treatment	1	96.79	96.79	3.65
Rep. by Treat.	1	9.28	9.28	.35
Within	105	2,783.44	26.51	
Total	108	2,913.89		

TABLE 6c

MEAN SCORES ON LOGIC SUB-TEST
GRADE TWO

Replication 1 (R_1)				Replication 2 (R_2)			
N = 21 Experimental		N = 29 Control		N = 26 Experimental		N = 34 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.38	9.10	4.86	6.79	5.35	9.38	4.26	7.74

TABLE 6d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE TWO

	Pretest	Posttest	Gain
R_1	5.92	7.76	1.84
R_2	5.68	8.45	2.77
T_1	6.26	9.36	3.10
T_2	4.54	7.30	2.76

TABLE 7b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE TWO

Source	df	SS	MS	F
Replication	1	25.21	25.21	5.90*
Treatment	1	50.15	50.15	11.73**
Rep. by Treat.	1	.41	.41	.10
Within	105	448.71	4.27	
Total	108	524.48		

*Significant at the .05 level
**Significant at the .01 level

TABLE 6e

MEAN SCORES ON GENERAL SUB-TEST
GRADE TWO

Replication 1 (R_1)				Replication 2 (R_2)			
N = 21 Experimental		N = 29 Control		N = 26 Experimental		N = 34 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.24	6.24	4.28	5.97	4.46	6.46	5.24	6.18

TABLE 6f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE TWO

	Pretest	Posttest	Gain
R_1	4.68	6.08	1.40
R_2	4.90	6.30	1.40
T_1	4.81	6.36	1.55
T_2	4.79	6.08	1.29

TABLE 7c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE TWO

Source	df	SS	MS	F
Replication	1	.96	.96	.21
Treatment	1	2.12	2.12	.45
Rep. by Treat.	1	.35	.35	.08
Within	105	491.33	4.68	
Total	108	494.76		

TABLE 6g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE TWO

Replication 1 (R_1)				Replication 2 (R_2)			
N = 21 Experimental		N = 29 Control		N = 26 Experimental		N = 34 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.90	10.05	4.93	8.34	4.69	8.19	7.06	9.00

TABLE 6h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE TWO

	Pretest	Posttest	Gain
R_1	5.76	9.06	3.30
R_2	6.03	8.65	2.62
T_1	5.68	9.02	3.34
T_2	6.08	8.70	2.62

TABLE 7d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE TWO

	df	SS	MS	F
Replication	1	6.73	6.73	.70
Treatment	1	5.22	5.22	.54
Rep. by Treat.	1	8.35	8.35	.86
Within	105	1,015.71	9.67	
Total	108	1,036.01		

TABLE 6i

MEAN SCORES ON READING TEST TOTAL
GRADE TWO

Replication 1 (R_1)				Replication 2 (R_2)			
N = 21 Experimental		N = 29 Control		N = 26 Experimental		N = 34 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
72.00	85.38	61.21	81.97	64.73	78.85	73.76	84.06

TABLE 6j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE TWO

	Pretest	Posttest	Gain
R_1	65.74	83.34	17.60
R_2	69.85	81.80	11.95
T_1	67.98	81.77	13.79
T_2	67.03	83.13	16.10

TABLE 7e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE TWO

Source	df	SS	MS	F
Replication	1	271.59	271.59	9.77**
Treatment	1	47.41	47.41	1.71
Rep. by Treat.	1	3.61	3.61	.13
Within	105	2,918.45	27.79	
Total	108	3,241.06		

**Significant at the .01 level

TABLE 8a

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE THREE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 27 Experimental		N = 26 Control		N = 32 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
28.93	36.96	13.19	16.15	15.00	21.91	23.26	27.59

TABLE 8b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE THREE

	Pretest	Posttest	Gain
R_1	21.21	26.75	5.54
R_2	18.78	24.12	5.34
T_1	21.37	28.80	7.43
T_2	18.32	21.98	3.66

TABLE 9a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE THREE

Source	df	SS	MS	F
Replication	1	8.07	8.07	.34
Treatment	1	529.08	529.08	22.15**
Rep. by Treat.	1	234.10	234.10	9.80**
Within	107	2,556.30	23.89	
Total	110	3,327.55		

**Significant at the .01 level

TABLE 8c

MEAN SCORES ON LOGIC SUB-TEST
GRADE THREE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 27 Experimental		N = 26 Control		N = 32 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
9.89	13.48	4.96	6.38	5.19	9.09	8.11	9.52

TABLE 8d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE THREE

	Pretest	Posttest	Gain
R_1	7.47	10.00	2.53
R_2	6.53	9.29	2.76
T_1	7.35	11.10	3.75
T_2	6.57	7.99	1.42

TABLE 9b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE THREE

Source	df	SS	MS	F
Replication	1	3.98	3.98	.88
Treatment	1	209.95	209.95	46.38**
Rep. by Treat.	1	67.36	67.36	14.88**
Within	107	484.34	4.53	
Total	110	765.63		

**Significant at the .01 level

TABLE 8e

MEAN SCORES ON GENERAL SUB-TEST
GRADE THREE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 27 Experimental		N = 26 Control		N = 32 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.70	9.52	3.88	4.81	4.47	5.28	6.15	6.89

TABLE 8f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE THREE

	Pretest	Posttest	Gain
R_1	5.83	7.21	1.38
R_2	5.24	6.02	.78
T_1	5.96	7.21	1.25
T_2	5.04	5.88	.84

TABLE 9c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE THREE

Source	df	SS	MS	F
Replication	1	21.99	21.99	6.20*
Treatment	1	19.58	19.58	5.52*
Rep. by Treat.	1	52.52	52.52	14.80**
Within	107	379.80	3.55	
Total	110	473.89		

*Significant at the .05 level
**Significant at the .01 level

TABLE 8g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE THREE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 27 Experimental		N = 26 Control		N = 32 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
11.26	14.00	4.35	4.85	5.34	7.53	9.00	11.19

TABLE 8h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE THREE

	Pretest	Posttest	Gain
R_1	7.87	9.51	1.64
R_2	7.02	9.20	2.18
T_1	8.06	10.49	2.43
T_2	6.71	8.11	1.40

TABLE 9d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE THREE

Source	df	SS	MS	F
Replication	1	1.06	1.06	.14
Treatment	1	62.93	62.93	8.52**
Rep. by Treat.	1	124.48	124.48	16.85**
Within	107	790.21	7.39	
Total	110	978.68		

**Significant at the .01 level

TABLE 8i

MEAN SCORES ON READING TEST TOTAL
GRADE THREE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 27 Experimental		N = 26 Control		N = 32 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
84.89	91.44	40.15	60.11	62.19	71.66	69.96	87.26

TABLE 8j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE THREE

	Pretest	Posttest	Gain
R_1	52.95	64.00	11.05
R_2	65.74	78.80	13.06
T_1	72.58	80.71	7.13
T_2	55.34	73.94	18.60

TABLE 9e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE THREE

Source	df	SS	MS	F
Replication	1	46.79	46.79	.63
Treatment	1	116.09	116.09	1.56
Rep. by Treat.	1	1,158.99	1,158.99	15.57**
Within	107	7,965.38	74.44	
Total	110	9,287.25		

**Significant at the .01 level

TABLE 10a

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE FOUR

Replication 1 (R_1)				Replication 2 (R_2)			
N = 28 Experimental		N = 34 Control		N = 32 Experimental		N = 24 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
15.36	20.75	16.15	16.68	14.13	15.38	17.00	18.00

TABLE 10b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE FOUR

	Pretest	Posttest	Gain
R_1	15.79	18.52	2.73
R_2	15.36	16.61	1.25
T_1	14.87	17.88	3.01
T_2	16.50	17.22	.72

TABLE 11a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE FOUR

Source	df	SS	MS	F
Replication	1	114.90	114.90	5.54*
Treatment	1	86.35	86.35	4.16*
Rep. by Treat.	1	209.85	209.85	10.11**
Within	113	2,344.97	20.75	
Total	116	2,756.07		

*Significant at the .05 level
**Significant at the .01 level

TABLE 10c

MEAN SCORES ON LOGIC SUB-TEST
GRADE FOUR

Replication 1 (R_1)				Replication 2 (R_2)			
N = 28 Experimental		N = 34 Control		N = 32 Experimental		N = 24 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.18	9.39	5.97	6.71	5.19	6.09	5.88	7.17

TABLE 10d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE FOUR

	Pretest	Posttest	Gain
R_1	6.06	7.92	1.86
R_2	5.48	6.55	1.07
T_1	5.82	7.64	1.82
T_2	5.92	6.89	.97

TABLE 11b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE FOUR

Source	df	SS	MS	F
Replication	1	51.06	51.06	9.65**
Treatment	1	19.05	19.05	3.60
Rep. by Treat.	1	89.76	89.76	16.97**
Within	113	597.72	5.29	
Total	116	757.59		

**Significant at the .01 level

TABLE 10e

MEAN SCORES ON GENERAL SUB-TEST
GRADE FOUR

Replication 1 (R_1)				Replication 2 (R_2)			
N = 28 Experimental		N = 34 Control		N = 32 Experimental		N = 24 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.46	5.46	4.74	4.56	3.84	4.09	5.29	5.04

TABLE 10f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE FOUR

	Pretest	Posttest	Gain
R_1	4.61	4.97	.36
R_2	4.46	4.50	.04
T_1	4.13	4.74	.61
T_2	4.96	4.76	-.20

TABLE 11c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE FOUR

Source	df	SS	MS	F
Replication	1	5.96	5.96	1.50
Treatment	1	2.22	2.22	.56
Rep. by Treat.	1	14.29	14.29	3.60
Within	113	448.48	3.97	
Total	116	470.95		

TABLE 10g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE FOUR

Replication 1 (R_1)				Replication 2 (R_2)			
N = 28 Experimental		N = 34 Control		N = 32 Experimental		N = 24 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.71	5.89	5.50	5.41	5.09	5.16	5.83	5.79

TABLE 10h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE FOUR

	Pretest	Posttest	Gain
R_1	5.15	5.63	.48
R_2	5.41	5.43	.02
T_1	4.92	5.50	.58
T_2	5.62	5.57	-.05

TABLE 11d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE FOUR

Source	df	SS	MS	F
Replication	1	2.70	2.70	.46
Treatment	1	.70	.70	.12
Rep. by Treat.	1	9.26	9.26	1.58
Within	113	660.73	5.85	
Total	116	673.39		

TABLE 10i

MEAN SCORES ON READING TEST TOTAL
GRADE FOUR

Replication 1 (R_1)				Replication 2 (R_2)			
N = 28 Experimental		N = 34 Control		N = 32 Experimental		N = 24 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
54.32	73.57	53.97	66.65	36.34	47.84	60.75	73.88

TABLE 10j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE FOUR

	Pretest	Posttest	Gain
R_1	54.13	69.77	15.64
R_2	48.77	59.00	10.23
T_1	44.73	59.85	15.12
T_2	56.78	69.64	12.86

TABLE 11e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE FOUR

Source	df	SS	MS	F
Replication	1	644.48	644.48	6.19*
Treatment	1	1.14	1.14	.01
Rep. by Treat.	1	983.03	983.03	9.44**
Within	113	11,764.56	104.11	
Total	116	13,393.21		

*Significant at the .05 level
**Significant at the .01 level

TABLE 12a

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE FIVE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 29 Control		N = 34 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
19.00	23.77	24.62	27.28	21.03	29.03	21.96	26.26

TABLE 12b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE FIVE

	Pretest	Posttest	Gain
R_1	21.96	25.62	3.66
R_2	21.44	27.80	6.36
T_1	20.33	26.75	6.42
T_2	23.34	26.79	3.45

TABLE 13a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE FIVE

Source	df	SS	MS	F
Replication	1	169.79	169.79	5.46*
Treatment	1	221.30	221.30	7.11**
Rep. by Treat.	1	29.16	29.16	.94
Within	111	3,454.07	31.12	
Total	114	3,874.32		

*Significant at the .05 level
**Significant at the .01 level

TABLE 12c

MEAN SCORES ON LOGIC SUB-TEST
GRADE FIVE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 29 Control		N = 34 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.85	10.23	9.03	10.03	8.24	12.79	7.93	8.41

TABLE 12d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE FIVE

	Pretest	Posttest	Gain
R_1	8.00	10.13	2.13
R_2	8.10	10.85	2.75
T_1	7.70	11.69	3.99
T_2	8.32	9.25	.93

TABLE 13b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE FIVE

Source	df	SS	MS	F
Replication	1	5.04	5.04	.55
Treatment	1	247.40	247.40	26.93**
Rep. by Treat.	1	49.84	49.84	5.43*
Within	111	1,019.57	9.19	
Total	114	1,321.87		

*Significant at the .05 level
**Significant at the .01 level

TABLE 12e

MEAN SCORES ON GENERAL SUB-TEST
GRADE FIVE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 29 Control		N = 34 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.08	6.38	7.86	8.41	6.24	8.06	7.70	8.78

TABLE 12f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE FIVE

	Pretest	Posttest	Gain
R_1	7.49	7.45	-.04
R_2	6.89	8.38	1.49
T_1	6.73	7.33	.60
T_2	7.43	8.59	1.16

TABLE 13c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE FIVE

Source	df	SS	MS	F
Replication	1	50.04	50.04	9.69**
Treatment	1	9.42	9.42	1.82
Rep. by Treat.	1	20.62	20.62	3.99*
Within	111	573.50	5.17	
Total	114	653.58		

*Significant at the .05 level
**Significant at the .01 level

TABLE 12g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE FIVE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 29 Control		N = 34 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.08	7.15	7.72	8.83	6.56	8.18	7.44	9.07

TABLE 12h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE FIVE

	Pretest	Posttest	Gain
R_1	6.47	8.04	1.57
R_2	6.95	8.57	1.62
T_1	5.90	7.73	1.83
T_2	7.59	8.95	1.36

TABLE 13d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE FIVE

Source	df	SS	MS	F
Replication	1	1.56	1.56	.21
Treatment	1	.34	.34	.04
Rep. by Treat.	1	1.02	1.02	.13
Within	111	842.01	7.59	
Total	114	844.93		

TABLE 12i

MEAN SCORES ON READING TEST TOTAL
GRADE FIVE

Replication 1 (R_1)				Replication 2 (R_2)			
N = 26 Experimental		N = 29 Control		N = 34 Experimental		N = 27 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
81.58	89.08	96.52	98.07	74.59	87.68	79.56	91.52

TABLE 12j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE FIVE

	Pretest	Posttest	Gain
R_1	89.45	93.82	4.37
R_2	76.79	89.38	12.59
T_1	77.62	88.28	10.66
T_2	88.34	94.91	6.57

TABLE 13e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE FIVE

Source	df	SS	MS	F
Replication	1	687.33	687.33	6.85*
Treatment	1	67.34	67.34	.67
Rep. by Treat.	1	43.94	43.94	.44
Within	111	11,139.30	100.35	
Total	114	11,937.91		

*Significant at the .05 level

TABLE 14a

MEAN SCORES ON CRITICAL READING TEST TOTAL
GRADE SIX

Replication 1 (R_1)				Replication 2 (R_2)			
N = 29 Experimental		N = 24 Control		N = 26 Experimental		N = 19 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
25.10	29.93	26.71	29.71	19.69	27.27	21.16	25.63

TABLE 14b

MAIN EFFECT MEANS ON CRITICAL READING TEST TOTAL
GRADE SIX

	Pretest	Posttest	Gain
R_1	25.83	29.83	4.00
R_2	20.31	26.58	6.27
T_1	22.55	28.67	6.12
T_2	24.23	27.91	3.42

TABLE 15a

ANALYSIS OF COVARIANCE OF CRITICAL READING TEST TOTAL
GRADE SIX

Source	df	SS	MS	F
Replication	1	86.83	86.83	2.33
Treatment	1	140.17	140.17	3.75
Rep. by Treat.	1	9.79	9.79	.26
Within	93	3,472.14	37.33	
Total	96	3,708.93		

TABLE 14c

MEAN SCORES ON LOGIC SUB-TEST
GRADE SIX

Replication 1 (R_1)				Replication 2 (R_2)			
N = 29 Experimental		N = 24 Control		N = 26 Experimental		N = 19 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
9.97	11.90	10.25	10.96	7.42	12.04	8.16	9.95

TABLE 14d

MAIN EFFECT MEANS ON LOGIC SUB-TEST
GRADE SIX

	Pretest	Posttest	Gain
R_1	10.09	11.47	1.38
R_2	7.73	11.16	3.43
T_1	8.70	11.99	3.29
T_2	9.32	10.52	1.20

TABLE 15b

ANALYSIS OF COVARIANCE OF LOGIC SUB-TEST
GRADE SIX

Source	df	SS	MS	F
Replication	1	28.04	28.04	2.33
Treatment	1	78.71	78.71	6.53*
Rep. by Treat.	1	12.42	12.42	1.03
Within	93	1,120.88	12.05	
Total	96	1,240.05		

*Significant at the .05 level

TABLE 14e

MEAN SCORES ON GENERAL SUB-TEST
GRADE SIX

Replication 1 (R_1)				Replication 2 (R_2)			
N = 29 Experimental		N = 24 Control		N = 26 Experimental		N = 19 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
8.03	9.31	8.25	8.83	6.12	7.54	6.42	7.79

TABLE 14f

MAIN EFFECT MEANS ON GENERAL SUB-TEST
GRADE SIX

	Pretest	Posttest	Gain
R_1	8.13	9.09	.96
R_2	6.24	7.64	1.40
T_1	7.10	8.49	1.39
T_2	7.44	8.38	.94

TABLE 15c

ANALYSIS OF COVARIANCE OF GENERAL SUB-TEST
GRADE SIX

Source	df	SS	MS	F
Replication	1	.02	.02	.00
Treatment	1	2.94	2.94	.52
Rep. by Treat.	1	2.58	2.58	.46
Within	93	526.63	5.66	
Total	96	532.17		

TABLE 14g

MEAN SCORES ON LITERATURE SUB-TEST
GRADE SIX

Replication 1 (R_1)				Replication 2 (R_2)			
N = 29 Experimental		N = 24 Control		N = 26 Experimental		N = 19 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.45	8.72	8.21	9.88	6.15	7.46	6.53	7.89

TABLE 14h

MAIN EFFECT MEANS ON LITERATURE SUB-TEST
GRADE SIX

	Pretest	Posttest	Gain
R_1	7.79	9.25	1.46
R_2	6.31	7.64	1.33
T_1	6.75	8.19	1.44
T_2	7.47	9.01	1.54

TABLE 15d

ANALYSIS OF COVARIANCE OF LITERATURE SUB-TEST
GRADE SIX

Source	df	SS	MS	F
Replication	1	12.73	12.73	1.51
Treatment	1	6.38	6.38	.75
Rep. by Treat.	1	1.48	1.48	.18
Within	93	785.88	8.45	
Total	96	806.47		

TABLE 14i

MEAN SCORES ON READING TEST TOTAL
GRADE SIX

Replication 1 (R_1)				Replication 2 (R_2)			
N = 29 Experimental		N = 24 Control		N = 26 Experimental		N = 19 Control	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
94.90	101.66	93.83	99.13	76.46	88.31	76.26	89.68

TABLE 14j

MAIN EFFECT MEANS ON READING TEST TOTAL
GRADE SIX

	Pretest	Posttest	Gain
R_1	94.42	100.51	6.09
R_2	76.38	88.89	12.51
T_1	86.18	95.35	9.17
T_2	86.19	94.98	8.79

TABLE 15e

ANALYSIS OF COVARIANCE OF READING TEST TOTAL
GRADE SIX

Source	df	SS	MS	F
Replication	1	40.04	40.04	.50
Treatment	1	2.33	2.33	.03
Rep. by Treat.	1	64.33	64.33	.81
Within	93	7,420.96	79.80	
Total	96	7,527.66		

TABLE 18a

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY REPLICATION, TREATMENT, AND GRADE FOR GRADES ONE-TWO

Replication 1								Replication 2							
Grade 1				Grade 2				Grade 1				Grade 2			
Experimental (26)		Control (28)		Experimental (21)		Control (29)		Experimental (24)		Control (22)		Experimental (26)		Control (34)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
50.19	62.23	49.36	67.64	72.00	85.38	61.21	81.96	54.17	81.00	26.14	42.86	64.73	78.85	73.76	84.06

TABLE 18b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 18a

	Pretest	Posttest	Gain
Replication 1	57.44	73.87	16.43
Replication 2	57.23	73.54	16.31
Grade 1	45.62	63.99	18.37
Grade 2	67.44	82.55	15.11
Treatment 1	59.79	76.34	16.55
Treatment 2	55.22	71.43	16.21

TABLE 19a

ANALYSIS OF COVARIANCE FOR TABLES 18a AND 18b

Source	df	SS	MS	F
Replication	1	30.70	30.70	.63
Grade	1	868.99	868.99	17.83**
Treatment	1	262.59	262.59	5.39*
Rep. by Grade	1	337.20	337.20	6.92*
Rep. by Treatment	1	3029.29	3029.29	62.14**
Grade by Treatment	1	846.10	846.10	17.36**
Rep. by Grade by Treat.	1	1588.17	1588.17	32.58**
Within	201	9797.87	48.75	
Total	208	16760.91		

*Significant at the .05 level
**Significant at the .01 level

TABLE 20a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY REPLICATION, TREATMENT, AND GRADE FOR GRADES TWO-THREE

Replication 1								Replication 2							
Grade 2				Grade 3				Grade 2				Grade 3			
Experimental (21)		Control (29)		Experimental (27)		Control (26)		Experimental (26)		Control (34)		Experimental (32)		Control (27)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
19.52	25.38	14.07	21.10	28.93	36.96	13.19	16.11	14.50	24.23	16.56	22.91	15.00	21.91	22.26	27.59

TABLE 20b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 20a

	Pretest	Posttest	Gain
Replication 1	18.85	24.14	5.29
Replication 2	16.98	23.99	7.01
Grade 2	15.98	23.22	7.24
Grade 3	19.69	25.56	5.87
Treatment 1	19.32	27.00	7.68
Treatment 2	16.51	22.03	5.52

TABLE 21a

ANALYSIS OF COVARIANCE FOR TABLES 20a AND 20b

Source	df	SS	MS	F
Replication	1	1.27	1.27	.05
Grade	1	22.53	22.53	.89
Treatment	1	534.29	534.29	21.09**
Rep. by Grade	1	25.69	25.69	1.01
Rep. by Treatment	1	154.44	154.44	6.10*
Grade by Treatment	1	119.88	119.88	4.73*
Rep. by Grade by Treat.	1	443.69	443.69	17.51**
Within	213	5396.37	25.34	
Total	220	6698.16		

*Significant at the .05 level
**Significant at the .01 level

TABLE 20b

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY REPLICATION, TREATMENT AND GRADE FOR GRADES TWO-THREE

Replication 1								Replication 2							
Grade 2				Grade 3				Grade 2				Grade 3			
Experimental (21)		Control (29)		Experimental (27)		Control (26)		Experimental (26)		Control (34)		Experimental (32)		Control (27)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.38	9.10	4.86	6.79	9.89	13.48	4.96	6.38	5.35	9.38	4.26	7.74	5.19	9.09	8.11	9.52

TABLE 20c

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 20b

	Pretest	Posttest	Gain
Replication 1	6.72	8.91	2.19
Replication 2	5.62	8.86	3.24
Grade 2	5.42	8.36	2.94
Grade 3	6.97	9.62	2.65
Treatment 1	6.86	10.28	3.42
Treatment 2	5.46	7.61	2.15

TABLE 21b

ANALYSIS OF COVARIANCE FOR TABLES 20b AND 20c

Source	df	SS	MS	F
Replication	1	5.58	5.58	1.27
Grade	1	20.60	20.60	4.67*
Treatment	1	233.85	233.85	52.98**
Rep. by Grade	1	23.95	23.95	5.43*
Rep. by Treatment	1	69.89	69.89	15.83**
Grade by Treatment	1	30.93	30.93	7.01**
Rep. by Grade by Treat.	1	60.76	60.76	13.77**
Within	213	940.13	4.41	
Total	220	1385.69		

*Significant at the .05 level
**Significant at the .01 level

TABLE 20d

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES TWO-THREE

Replication 1								Replication 2							
Grade 2				Grade 3				Grade 2				Grade 3			
Experimental (21)		Control (29)		Experimental (27)		Control (26)		Experimental (26)		Control (34)		Experimental (32)		Control (27)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.24	6.24	4.28	5.97	7.70	9.52	3.88	4.81	4.46	6.46	5.24	6.18	4.47	5.28	6.15	6.89

TABLE 20e

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 20d

	Pretest	Posttest	Gain
Replication 1	5.27	6.66	1.39
Replication 2	5.07	6.16	1.09
Grade 2	4.80	6.20	1.40
Grade 3	5.52	6.58	1.06
Treatment 1	5.44	6.84	1.40
Treatment 2	4.91	5.98	1.07

TABLE 21c

ANALYSIS OF COVARIANCE FOR TABLES 20d AND 20e

Source	df	SS	MS	F
Replication	1	10.85	10.85	2.55
Grade	1	.26	.26	.06
Treatment	1	24.64	24.64	5.79*
Rep. by Grade	1	12.79	12.79	3.00
Rep. by Treatment	1	48.16	48.16	11.31**
Grade by Treatment	1	8.08	8.08	1.90
Rep. by Grade by Treat	1	82.07	82.07	19.27**
Within	213	907.18	4.26	
Total	220	1094.03		

*Significant at the .05 level
**Significant at the .01 level

TABLE 20f

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES TWO-THREE

Replication 1								Replication 2							
Grade 2				Grade 3				Grade 2				Grade 3			
Experimental (21)		Control (29)		Experimental (27)		Control (26)		Experimental (26)		Control (34)		Experimental (32)		Control (27)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.90	10.05	4.93	8.34	11.26	14.00	4.34	4.85	4.69	8.19	7.06	9.00	5.34	7.53	9.00	11.19

TABLE 20g

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 20f

	Pretest	Posttest	Gain
Replication 1	6.84	9.29	2.45
Replication 2	6.52	8.92	2.40
Grade 2	5.91	8.84	2.93
Grade 3	7.42	9.35	1.93
Treatment 1	7.00	9.84	2.84
Treatment 2	6.37	8.41	2.04

TABLE 21d

ANALYSIS OF COVARIANCE FOR TABLES 20f AND 20g

Source	df	SS	MS	F
Replication	1	3.16	3.16	.36
Grade	1	5.93	5.93	.68
Treatment	1	68.26	68.26	7.85**
Rep. by Grade	1	13.84	13.84	1.59
Rep. by Treatment	1	143.99	143.99	16.55**
Grade by Treatment	1	20.88	20.88	2.40
Rep. by Grade by Treat.	1	164.62	164.62	18.92**
Within	213	1852.76	8.70	
Total	220	2273.44		

**Significant at the .01 level

TABLE 22a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

Replication 1												Replication 2											
Grade 4				Grade 5				Grade 6				Grade 4				Grade 5				Grade 6			
Exper. (28)		Control (34)		Exper. (26)		Control (29)		Exper. (29)		Control (24)		Exper. (32)		Control (24)		Exper. (34)		Control (27)		Exper. (26)		Control (19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
15.36	20.75	16.15	16.68	19.00	23.77	24.62	27.28	25.10	29.93	26.71	29.71	14.13	15.38	17.00	18.00	21.03	29.03	21.96	26.26	19.69	27.27	21.16	25.63

TABLE 22b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 22a

	Pretest	Posttest	Gain
Replication 1	20.92	24.34	3.42
Replication 2	19.03	23.56	4.53
Grade 4	15.59	17.56	1.97
Grade 5	21.69	26.77	5.08
Grade 6	23.29	28.34	5.05
Treatment 1	19.03	24.32	5.29
Treatment 2	21.06	23.56	2.50

TABLE 23a

ANALYSIS OF COVARIANCE FOR TABLES 22a AND 22b

Source	df	SS	MS	F
Replication	1	31.24	31.24	1.06
Grade	2	842.28	421.11	14.22**
Treatment	1	519.20	519.20	17.54**
Rep. by Grade	2	303.12	151.56	5.12**
Rep. by Treatment	1	6.02	6.02	.20
Grade by Treatment	2	5.05	2.52	.09
Rep. by Grade by Treat	2	204.77	102.38	3.48*
Within	319	9444.09	29.61	
Total	330	11355.72		

*Significant at the .05 level
**Significant at the .01 level

TABLE 22c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

Replication 1												Replication 2											
Grade 4				Grade 5				Grade 6				Grade 4				Grade 5				Grade 6			
Exper. (28		Control (34)		Exper. (26)		Control (29)		Exper. (29)		Control (24)		Exper. (32)		Control (24)		Exper. (34)		Control (27)		Exper. (26)		Control (19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.18	9.39	5.97	6.71	6.85	10.23	9.03	10.03	9.97	11.90	10.25	10.96	5.19	6.09	5.88	7.17	8.24	12.79	7.93	8.41	7.42	12.04	8.16	9.95

TABLE 22d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 22c

	Pretest	Posttest	Gain
Replication 1	7.95	9.74	1.79
Replication 2	7.09	9.45	3.36
Grade 4	5.86	7.27	1.41
Grade 5	8.00	10.51	2.51
Grade 6	8.97	11.34	2.37
Treatment 1	7.31	10.38	3.07
Treatment 2	6.98	8.73	1.75

TABLE 23b

ANALYSIS OF COVARIANCE FOR TABLES 22c AND 22d

Source	df	SS	MS	F
Replication	1	.00	.00	.00
Grade	2	270.07	135.03	15.41**
Treatment	1	300.33	300.33	34.27**
Rep. by Grade	2	64.63	32.31	3.69*
Rep. by Treatment	1	1.77	1.77	.20
Grade by Treatment	2	59.53	29.77	3.40*
Rep. by Grade by Treat.	2	143.77	71.88	8.20**
Within	319	2795.42	8.76	
Total	330	3635.52		

*Significant at the .05 level
**Significant at the .01 level

TABLE 22e

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

Replication 1												Replication 2											
Grade 4				Grade 5				Grade 6				Grade 4				Grade 5				Grade 6			
Exper. (28)		Control (34)		Exper. (26)		Control (29)		Exper. (29)		Control (24)		Exper. (32)		Control (24)		Exper. (34)		Control (27)		Exper. (26)		Control (19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.71	5.89	5.50	5.41	5.08	7.15	7.72	8.83	7.45	8.72	8.21	9.88	5.09	5.16	5.83	5.79	6.56	8.18	7.44	9.07	6.15	7.46	6.53	7.89

TABLE 22f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 22e

	Pretest	Posttest	Gain
Replication 1	6.40	7.53	1.13
Replication 2	6.24	7.23	.99
Grade 4	5.27	5.53	.26
Grade 5	6.72	8.32	1.60
Grade 6	7.11	8.51	1.40
Treatment 1	5.86	7.09	1.23
Treatment 2	6.83	7.71	.88

TABLE 23c

ANALYSIS OF COVARIANCE FOR TABLES 22e AND 22f

Source	df	SS	MS	F
Replication	1	5.16	5.16	.71
Grade	2	279.82	139.91	19.15**
Treatment	1	.88	.88	.12
Rep. by Grade	2	16.09	8.04	1.10
Rep. by Treatment	1	2.41	2.41	.33
Grade by Treatment	2	11.37	5.69	.78
Rep. by Grade by Treat.	2	9.19	4.60	.63
Within	319	2330.57	7.31	
Total	330	2655.49		

**Significant at the .01 level

TABLE 22g

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

Replication 1												Replication 2											
Grade 4				Grade 5				Grade 6				Grade 4				Grade 5				Grade 6			
Exper. (28)		Control (34)		Exper. (26)		Control (29)		Exper. (29)		Control (24)		Exper. (32)		Control (24)		Exper. (34)		Control (27)		Exper. (26)		Control (19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.46	5.46	4.74	4.56	7.08	6.38	7.86	8.41	8.03	9.31	8.25	8.83	3.84	4.09	5.29	5.04	6.24	8.06	7.70	8.78	6.12	7.54	6.42	7.79

TABLE 22h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 22g

	Pretest	Posttest	Gain
Replication 1	6.64	7.06	.42
Replication 2	5.87	6.83	.96
Grade 4	4.54	4.74	.20
Grade 5	7.17	7.94	.77
Grade 6	7.27	8.43	1.16
Treatment 1	5.92	6.80	.88
Treatment 2	6.65	7.11	.46

TABLE 23d

ANALYSIS OF COVARIANCE FOR TABLES 22g AND 22h

Source	df	SS	MS	F
Replication	1	3.46	3.46	.69
Grade	2	210.76	105.38	21.11**
Treatment	1	1.04	1.04	.21
Rep. by Grade	2	56.26	28.13	5.63*
Rep. by Treatment	1	.04	.04	.01
Grade by Treatment	2	17.06	8.53	1.71
Rep. by Grade by Treat.	2	33.52	16.76	3.36*
Within	319	1592.61	4.99	
Total	330	1914.75		

*Significant at the .05 level
**Significant at the .01 level

TABLE 22i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY REPLICATION, TREATMENT, AND GRADE FOR GRADES FOUR-FIVE-SIX

Replication 1												Replication 2											
Grade 4				Grade 5				Grade 6				Grade 4				Grade 5				Grade 6			
Exper. (28)		Control (34)		Exper. (26)		Control (29)		Exper. (29)		Control (24)		Exper. (32)		Control (24)		Exper. (34)		Control (27)		Exper. (26)		Control (19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
54.32	73.57	53.97	66.65	81.58	89.08	96.52	98.07	94.90	101.66	93.83	99.13	36.34	47.84	60.75	73.88	74.59	87.68	79.56	91.52	76.46	88.31	76.26	89.68

TABLE 22j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 22i

	Pretest	Posttest	Gain
Replication 1	78.11	87.14	9.03
Replication 2	66.31	78.74	12.43
Grade 4	50.65	64.66	14.01
Grade 5	82.79	91.48	8.69
Grade 6	86.18	95.18	9.00
Treatment 1	69.03	80.75	11.72
Treatment 2	75.99	85.59	9.60

TABLE 23e

ANALYSIS OF COVARIANCE FOR TABLES 22i AND 22j

	df	SS	MS	F
Replication	1	37.97	37.97	.40
Grade	2	283.78	141.89	1.48
Treatment	1	29.36	29.36	.31
Rep. by Grade	2	1654.19	827.10	8.65**
Rep. by Treatment	1	897.96	897.96	9.39**
Grade by Treatment	2	69.40	34.70	.36
Rep. by Grade by Treat	2	533.85	266.92	2.79
Within	319	30509.31	95.64	
Total	330	34015.82		

**Significant at the .01 level

TABLE 24a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade One, N = 100)

	Intelligence	General Reading			Personality			Critical Reading			
	NV	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.493*	.433*	.516*	.029	.019	-.044	.310*	.220	.385*	.434*
Voc			.558*	.989*	.104	.071	.067	.222	.280*	.318*	.371*
Comp				.676*	.192	.099	.118	.424*	.360*	.307*	.460*
G.R. Total					.127	.081	.081	.273*	.300*	.337*	.411*
Pers Adj						.607*	.812*	.262*	.060	.176	.212
Soc Adj							.845*	.330*	.120	.208	.287*
Pers Total								.342*	.150	.173	.284*
Logic									.320*	.308*	.731*
Gen										.420*	.710*
Lit											.767*
C.R. Total											

*Significant at the .01 level

TABLE 25a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Two, N = 110)

	Intelligence	General Reading			Personality			Critical Reading			
	NV	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.365*	.352*	.431*	.156	-.033	.073	.271*	.371*	.210	.319*
Voc			.649*	.816*	.085	.030	.067	.251	.150	.339*	.355*
Comp				.889*	.105	.122	.127	.276*	.290*	.307*	.402*
G.R. Total					.055	.007	.037	.270*	.270*	.333*	.406*
Pers Adj						.633*	.909*	.103	-.040	.081	.074
Soc Adj							.898*	.127	-.110	-.057	-.007
Pers Total								.129	-.080	.019	.042
Logic									.300*	.086	.631*
Gen										.410*	.750*
Lit											.746*
C.R. Total											

*Significant at the .01 level

TABLE 26a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Three, N = 112)

	Intelligence		General Reading			Personality			Critical Reading			
	NV	V	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.871*	.688*	.665*	.699*	.345*	.309*	.144	.670*	.610*	.641*	.700*
V			.772*	.738*	.780*	.443*	.323*	.173	.738*	.660*	.749*	.792*
Voc				.865*	.957*	.393*	.400*	.198	.671*	.650*	.720*	.753*
Comp					.974*	.351*	.317*	.232	.721*	.680*	.720*	.778*
G.R. Total						.382*	.368*	.225	.723*	.690*	.745*	.794*
Pers Adj							.557*	.179	.325*	.300*	.363*	.368*
Soc Adj								.161	.153	.130	.136	.154
Pers Total									.058	.260*	.217	.192
Logic										.760*	.759*	.918*
Gen											.720*	.880*
Lit												.928*
C.R. Total												

*Significant at the .01 level

TABLE 27a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Four, N = 118)

	Intelligence		General Reading			Personality			Critical Reading			
	NV	V	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.678*	.404*	.498*	.489*	.121	.135	.176	.099	.255*	.079	.240
V			.747*	.674*	.756*	.263*	.360*	.263*	.209	.501*	.269*	.526*
Voc				.740*	.914*	.264*	.386*	.272*	.177	.445*	.286*	.497*
Comp					.949*	.234	.419*	.239	.113	.521*	.363*	.542*
G.R. Total						.264*	.434*	.272*	.151	.523*	.353*	.560*
Pers Adj							.650*	.510*	-.009	.161	.093	.148
Soc Adj								.583*	.073	.390*	.350*	.341*
Pers Total									.088	.117	.002	.126
Logic										.134	-.022	.523*
Gen											.193	.666*
Lit												.664*
C.R. Total												

*Significant at the .01 level.

TABLE 28a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Five, N = 116)[1]

	Intelligence		General Reading			Personality			Critical Reading			
	NV	V	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.678*	.473*	.639*	.614*	.342*	.217	.312*	.300*	.363*	.304*	.439*
V			.601*	.729*	.730*	.430*	.384*	.453*	.335*	.545*	.471*	.565*
Voc				.706*	.898*	.274*	.253	.293*	.253	.524*	.413*	.500*
Comp					.946*	.293*	.230	.291*	.362*	.647*	.579*	.679*
G.R. Total						.311*	.262	.319*	.341*	.643*	.549*	.651*
Pers Adj							.620*	.906*	.436*	.273*	.328*	.430*
Soc Adj								.894*	.131	.189	.260	.255
Pers Total									.320*	.258*	.328*	.384*
Logic										.402*	.415*	.734*
Gen											.513*	.803*
Lit												.777*
C.R. Total												

*Significant at the .01 level
[1]N = 89 on the correlations with Personality

TABLE 29a

INTERCORRELATIONS OF INTELLIGENCE, GENERAL READING AND PERSONALITY WITH EACH OTHER AND WITH THE CRITERION OF CRITICAL READING

(Total Sample, Grade Six, N = 98)[1]

	Intelligence		General Reading			Personality			Critical Reading			
	NV	V	Voc	Comp	G.R. Total	Pers Adj	Soc Adj	Pers Total	Logic	Gen	Lit	C.R. Total
NV		.778*	.719*	.715*	.760*	.244	.185	.236	.520*	.553*	.373*	.602*
V			.771*	.775*	.819*	.439*	.333*	.416*	.624*	.666*	.523*	.745*
Voc				.777*	.928*	.457*	.348*	.438*	.502*	.599*	.524*	.675*
Comp					.956*	.365*	.270	.344*	.629*	.666*	.487*	.735*
G.R. Total						.436*	.327*	.414*	.607*	.674*	.534*	.751*
Pers Adj							.731*	.932*	.324*	.534*	.270	.459*
Soc Adj								.927*	.267	.440*	.160	.328*
Pers Total									.321*	.524*	.230	.425*
Logic										.561*	.404*	.809*
Gen											.571*	.831*
Lit												.750*
C.R. Total												

*Significant at the .01 level

[1]N = 69 on the correlations with personality

TABLE 32a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

Treatment 1												Treatment 2											
Low(3)				Middle(23)				High(24)				Low(9)				Middle(20)				High(21)			
Male(1)		Female(2)		Male(14)		Female(9)		Male(14)		Female(10)		Male(5)		Female(4)		Male(12)		Female(8)		Male(11)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
6.00	8.00	6.50	15.50	12.36	18.64	11.33	18.44	15.00	22.64	14.50	22.40	10.60	12.80	11.00	15.00	11.83	14.25	13.75	15.00	14.82	21.18	15.70	23.50

TABLE 32b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 32a

	N	Pretest	Posttest	Gain
Treatment 1	50	12.98	20.14	7.16
Treatment 2	50	13.38	17.66	4.28
High Intell.	45	15.00	22.42	7.42
Mid. Intell.	43	12.25	16.64	4.39
Low Intell.	12	9.67	13.58	3.91
Male	57	13.11	18.49	5.38
Female	43	13.26	19.42	6.18

TABLE 33a

ANALYSIS OF COVARIANCE FOR TABLES 32a AND 32b

Source	df	SS	MS	F
Treatment	1	143.02	143.02	4.99**
Intelligence	2	383.32	191.66	6.69
Sex	1	17.01	17.01	.59
Treat. x Intell.	2	82.46	41.23	1.44
Treat. x Sex	1	.06	.06	.00
Intell. x Sex	2	21.43	10.72	.37
Treat. x Intell. x Sex	2	23.98	11.99	.42
Within	87	2494.16	28.67	
Total	98	3165.44		

**Significant at the .01 level

TABLE 32c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

Treatment 1												Treatment 2											
Low(3)				Middle(23)				High(24)				Low(9)				Middle(20)				High(21)			
Male(1)		Female(2)		Male(14)		Female(9)		Male(14)		Female(10)		Male(5)		Female(4)		Male(12)		Female(8)		Male(11)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1.00	3.00	2.50	7.00	4.93	7.79	3.89	7.89	5.36	9.86	5.00	9.70	4.40	5.20	5.00	5.50	5.25	5.75	6.38	5.00	5.91	8.55	7.90	7.70

TABLE 32d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 32c

	N	Pretest	Posttest	Gain
Treatment 1	50	4.70	8.64	3.94
Treatment 2	50	6.00	6.56	.56
High Intell.	45	5.98	9.02	3.04
Mid. Intell.	43	5.07	6.72	1.65
Low Intell.	12	4.00	5.42	1.42
Male	57	5.18	7.70	2.52
Female	43	5.58	7.47	1.89

TABLE 33b

ANALYSIS OF COVARIANCE FOR TABLES 32c AND 32d

Source	df	SS	MS	F
Treatment	1	107.12	107.12	13.10**
Intelligence	2	128.48	64.24	7.86**
Sex	1	2.83	2.83	.35
Treat. x Intell.	2	9.30	4.64	.57
Treat. x Sex	1	10.70	10.70	1.31
Intell. x Sex	2	4.51	2.25	.28
Treat. x Intell. x Sex	2	2.09	1.05	.13
Within	87	711.34	8.18	
Total	98	976.37		

**Significant at the .01 level

TABLE 32e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

Treatment 1												Treatment 2											
Low(3)				Middle(23)				High(24)				Low(9)				Middle(20)				High(21)			
Male(1)		Female(2)		Male(14)		Female(9)		Male(14)		Female(10)		Male(5)		Female(4)		Male(12)		Female(8)		Male(11)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
2.00	1.00	2.00	2.50	2.86	3.86	3.44	3.89	3.21	3.92	4.00	4.20	2.40	2.60	2.50	4.50	2.25	3.92	3.25	3.75	3.91	4.55	2.80	6.70

TABLE 32f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 32e

	N	Pretest	Posttest	Gain
Treatment 1	50	3.24	3.84	.60
Treatment 2	50	2.92	4.50	1.58
High Intell.	45	3.47	4.76	1.29
Mid. Intell.	43	2.88	3.86	.98
Low Intell.	12	2.33	3.08	.75
Male	57	2.96	3.86	.90
Female	43	3.23	4.58	1.35

TABLE 33c

ANALYSIS OF COVARIANCE FOR TABLES 32e AND 32f

Source	df	SS	MS	F
Treatment	1	19.85	19.85	5.37**
Intelligence	2	18.61	9.31	2.52
Sex	1	9.57	9.57	2.59
Treat. x Intell.	2	10.19	5.10	1.38
Treat. x Sex	1	8.36	8.36	2.26
Intell. x Sex	2	16.71	8.35	2.26
Treat. x Intell. x Sex	2	11.13	5.56	1.51
Within	87	321.58	3.70	
Total	98	416.00		

**Significant at the .01 level

TABLE 32g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

Treatment 1												Treatment 2											
Low(3)				Middle(23)				High(24)				Low(9)				Middle(20)				High(21)			
Male(1)		Female(2)		Male(14)		Female(9)		Male(14)		Female(10)		Male(5)		Female(4)		Male(12)		Female(8)		Male(11)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
3.00	4.00	2.00	6.00	4.57	7.00	4.00	6.67	6.43	8.86	5.50	8.50	3.80	5.00	3.50	5.00	4.33	4.58	4.13	6.25	5.00	8.09	5.00	9.10

TABLE 32h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 32g

	N	Pretest	Posttest	Gain
Treatment 1	50	5.04	7.66	2.62
Treatment 2	50	4.46	6.60	2.14
High Intell.	45	5.56	8.65	3.09
Mid. Intell.	43	4.30	6.12	1.82
Low Intell.	12	3.34	5.08	1.74
Male	57	4.96	6.93	1.97
Female	43	4.47	7.40	2.93

TABLE 33d

ANALYSIS OF COVARIANCE FOR TABLES 32g AND 32h

Source	df	SS	MS	F
Treatment	1	8.26	8.26	1.45
Intelligence	2	80.72	40.36	7.07**
Sex	1	13.77	13.77	2.41
Treat. x Intell.	2	21.13	10.57	1.85
Treat. x Sex	1	6.15	6.15	1.08
Intell. x Sex	2	.21	.10	.02
Treat. x Intell. x Sex	2	7.61	3.81	.67
Within	87	496.50	5.71	
Total	98	634.35		

**Significant at the .01 level

TABLE 32i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE ONE

Treatment 1												Treatment 2											
Low(3)				Middle(23)				High(24)				Low(9)				Middle(20)				High(21)			
Male(1)		Female(2)		Male(14)		Female(9)		Male(14)		Female(10)		Male(5)		Female(4)		Male(12)		Female(8)		Male(11)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
35.00	22.00	56.50	78.00	46.71	62.36	53.11	68.56	53.36	77.71	57.80	80.60	26.20	48.20	27.00	38.50	28.75	43.33	40.75	63.25	43.90	63.00	56.40	72.30

TABLE 32j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 32i

	N	Pretest	Posttest	Gain
Treatment	50	52.10	71.24	19.14
Treatment 2	50	39.14	56.74	17.60
High Intell.	45	52.78	73.55	20.77
Mid. Intell.	43	41.93	58.51	16.58
Low Intell.	12	32.25	47.75	15.50
Male	57	42.02	60.30	18.28
Female	43	50.40	68.88	18.48

TABLE 33e

ANALYSIS OF COVARIANCE FOR TABLES 32i AND 32j

Source	df	SS	MS	F
Treatment	1	196.92	196.92	2.86
Intelligence	2	819.75	409.87	5.95**
Sex	1	62.27	62.27	.90
Treat. x Intell.	2	301.65	150.82	2.19
Treat. x Sex	1	.21	.21	.00
Intell. x Sex	2	225.17	112.58	1.63
Treat. x Intell. x Sex	2	1388.68	694.34	10.08**
Within	87	5991.59	68.87	
Total	98	8986.24		

**Significant at the .01 level

TABLE 34a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

Treatment 1												Treatment 2											
Low(3)				Middle(25)				High(19)				Low(17)				Middle(29)				High(17)			
Male(1)		Female(2)		Male(11)		Female(14)		Male(8)		Female(11)		Male(5)		Female(12)		Male(14)		Female(15)		Male(11)		Female(6)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
16.00	19.00	15.00	24.50	14.45	22.00	16.00	23.21	20.25	25.87	17.82	29.18	15.60	20.00	14.25	19.25	14.64	21.43	15.33	21.93	17.09	25.27	16.50	25.50

TABLE 34b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 34a

	N	Pretest	Posttest	Gain
Treatment 1	47	16.75	24.74	7.99
Treatment 2	63	15.41	22.08	6.67
High Intell.	36	17.92	26.58	8.66
Mid. Intell.	54	15.15	22.11	6.96
Low Intell.	20	14.75	19.95	5.20
Male	50	16.16	22.92	6.76
Female	60	15.83	23.46	7.63

TABLE 35a

ANALYSIS OF COVARIANCE FOR TABLES 34a AND 34b

Source	df	SS	MS	F
Treatment	1	34.08	34.08	1.39
Intelligence	2	399.92	199.96	8.17**
Sex	1	13.29	13.29	.54
Treat. x Intell.	2	6.90	3.45	.14
Treat. x Sex	1	29.82	29.82	1.22
Intell. x Sex	2	28.38	14.19	.58
Treat. x Intell. x Sex	2	26.61	13.31	.54
Within	97	2373.08	24.46	
Total	108	2912.08		

**Significant at the .01 level

TABLE 34c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

Treatment 1												Treatment 2											
Low(3)				Middle(25)				High(19)				Low(17)				Middle(29)				High(17)			
Male(1)		Female(2)		Male(11)		Female(14)		Male(8)		Female(11)		Male(5)		Female(12)		Male(14)		Female(15)		Male(11)		Female(6)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
8.00	6.00	7.00	8.50	4.82	8.55	5.79	9.29	7.38	9.75	7.18	10.00	4.00	5.60	4.50	7.00	4.36	7.14	5.07	7.27	4.27	7.91	4.67	8.67

TABLE 34d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 34c

	N	Pretest	Posttest	Gain
Treatment 1	47	6.26	9.36	3.10
Treatment 2	63	4.54	7.30	2.76
High Intell.	36	5.92	9.08	3.16
Mid. Intell.	54	5.13	8.02	2.89
Low Intell.	20	4.80	6.75	1.95
Male	50	4.96	7.86	2.90
Female	60	5.54	8.37	2.83

TABLE 35b

ANALYSIS OF COVARIANCE FOR TABLES 34c AND 34d

Source	df	SS	MS	F
Treatment	1	35.58	35.58	8.14**
Intelligence	2	61.01	30.51	6.97**
Sex	1	4.07	4.07	.93
Treat. x Intell.	2	3.30	1.65	.38
Treat. x Sex	1	.52	.52	.12
Intell. x Sex	2	5.43	2.71	.62
Treat. x Intell. x Sex	2	1.91	.96	.22
Within	97	424.27	4.37	
Total	108	536.09		

**Significant at the .01 level

TABLE 34e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

Treatment 1												Treatment 2											
Low(3)				Middle(25)				High(19)				Low(17)				Middle(29)				High(17)			
Male(1)		Female(2)		Male(11)		Female(14)		Male(8)		Female(11)		Male(5)		Female(12)		Male(14)		Female(15)		Male(11)		Female(6)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
3.00	4.00	5.50	5.50	3.55	6.18	5.14	6.14	5.75	6.38	5.00	7.18	5.40	6.00	4.42	5.08	4.21	5.64	4.67	6.00	6.00	7.18	4.50	7.33

TABLE 34f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 34e

	N	Pretest	Posttest	Gain
Treatment 1	47	4.81	6.36	1.55
Treatment 2	63	4.79	6.08	1.29
High Intell.	36	5.39	7.02	1.63
Mid. Intell.	54	4.44	5.98	1.54
Low Intell.	20	4.70	5.30	.60
Male	50	4.80	6.22	1.42
Female	60	4.80	6.18	1.38

TABLE 35c

ANALYSIS OF COVARIANCE FOR TABLES 34e AND 34f

Source	df	SS	MS	F
Treatment	1	.00	.00	.00
Intelligence	2	39.35	19.67	4.29**
Sex	1	.04	.04	.01
Treat. x Intell.	2	3.94	1.97	.43
Treat. x Sex	1	.20	.20	.04
Intell. x Sex	2	2.69	1.35	.29
Treat. x Intell. x Sex	2	4.01	2.00	.44
Within	97	444.47	4.58	
Total	108	494.70		

**Significant at the .01 level

TABLE 34g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

Treatment 1												Treatment 2											
Low(3)				Middle(25)				High(19)				Low(17)				Middle(29)				High(17)			
Male(1)		Female(2)		Male(11)		Female(14)		Male(8)		Female(11)		Male(5)		Female(12)		Male(14)		Female(15)		Male(11)		Female(6)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.00	9.00	2.50	10.50	6.09	6.82	5.07	7.79	7.13	9.75	5.64	12.00	6.20	8.40	5.33	7.17	6.07	8.64	5.60	8.67	6.82	10.18	7.33	9.50

TABLE 34h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 34g

	N	Pretest	Posttest	Gain
Treatment 1	47	5.68	9.02	3.34
Treatment 2	63	6.08	8.70	2.62
High Intell.	36	6.61	10.52	3.91
Mid. Intell.	54	5.68	8.06	2.38
Low Intell.	20	5.25	7.91	2.66
Male	50	6.40	8.74	2.34
Female	60	5.50	8.91	3.41

TABLE 35d

ANALYSIS OF COVARIANCE FOR TABLES 34g AND 34h

Source	df	SS	MS	F
Treatment	1	.26	.26	.03
Intelligence	2	117.75	58.87	7.09**
Sex	1	5.90	5.90	.71
Treat. x Intell.	2	55.11	27.55	3.32
Treat. x Sex	1	29.31	29.31	3.53
Intell. x Sex	2	9.74	4.87	.59
Treat. x Intell. x Sex	2	8.54	4.27	.51
Within	97	805.62	8.31	
Total	108	1032.23		

**Significant at the .01 level

TABLE 34i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE TWO

Treatment 1												Treatment 2											
Low(3)				Middle(25)				High(19)				Low(17)				Middle(29)				High(17)			
Male(1)		Female(2)		Male(11)		Female(14)		Male(8)		Female(11)		Male(5)		Female(12)		Male(14)		Female(15)		Male(11)		Female(6)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
52.00	76.00	71.50	77.50	60.36	76.00	66.21	81.79	68.50	82.88	78.27	88.00	59.80	80.00	63.50	81.33	64.71	83.93	69.60	82.93	75.00	85.18	74.50	83.83

TABLE 34j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 34i

	N	Pretest	Posttest	Gain
Treatment 1	47	67.98	81.77	13.79
Treatment 2	63	67.03	83.13	16.10
High Intell.	36	74.44	85.30	10.86
Mid. Intell.	54	65.57	81.47	15.90
Low Intell.	20	62.80	80.31	17.51
Male	50	65.88	81.74	15.86
Female	60	69.73	83.18	13.35

TABLE 35e

ANALYSIS OF COVARIANCE FOR TABLES 34i AND 34j

Source	df	SS	MS	F
Treatment	1	60.19	60.19	2.03
Intelligence	2	8.06	4.03	.14
Sex	1	.04	.04	.00
Treat. x Intell.	2	146.80	73.40	2.47
Treat. x Sex	1	69.95	69.95	2.36
Intell. x Sex	2	9.78	4.89	.16
Treat. x Intell. x Sex	2	73.88	36.94	1.24
Within	97	2878.42	29.67	
Total	108	3247.12		

TABLE 36a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

Treatment 1												Treatment 2											
Low(11)				Middle(20)				High(28)				Low(22)				Middle(9)				High(22)			
Male(8)		Female(3)		Male(10)		Female(10)		Male(14)		Female(14)		Male(13)		Female(9)		Male(4)		Female(5)		Male(17)		Female(5)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
12.88	18.13	9.00	15.67	18.50	26.30	17.80	25.30	28.00	35.64	26.86	35.14	11.77	14.54	13.67	15.78	14.50	19.75	20.60	21.40	23.88	29.18	25.60	30.40

TABLE 36b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 36a

	N	Pretest	Posttest	Gain
Treatment 1	59	21.37	28.80	7.43
Treatment 2	53	18.32	21.98	3.66
High Intell.	50	26.04	32.78	6.74
Mid. Intell.	29	18.07	24.21	6.14
Low Intell.	33	12.31	15.85	3.54
Male	66	19.65	25.32	5.67
Female	46	20.27	25.93	5.66

TABLE 37a

ANALYSIS OF COVARIANCE FOR TABLES 36a AND 36b

Source	df	SS	MS	F
Treatment	1	357.22	357.22	14.90**
Intelligence	2	472.05	236.03	9.85**
Sex	1	.34	.34	.01
Treat. x Intell.	2	9.40	4.70	.20
Treat. x Sex	1	9.06	9.06	.38
Intell. x Sex	2	10.50	5.25	.22
Treat. x Intell. x Sex	2	4.23	2.11	.09
Within	99	2372.78	23.97	
Total	110	3235.58		

**Significant at the .01 level

TABLE 36c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

Treatment 1												Treatment 2											
Low(11)				Middle(20)				High(28)				Low(22)				Middle(9)				High(22)			
Male(8)		Female(3)		Male(10)		Female(10)		Male(14)		Female(14)		Male(13)		Female(9)		Male(4)		Female(5)		Male(17)		Female(5)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.13	7.75	2.67	7.00	6.60	10.20	5.60	10.10	9.86	13.21	9.43	13.14	4.54	6.08	4.78	6.22	5.00	7.75	8.00	7.00	8.29	10.00	9.00	10.40

TABLE 36d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 36c

	N	Pretest	Posttest	Gain
Treatment 1	59	7.35	11.10	3.75
Treatment 2	53	6.57	7.99	1.42
High Intell.	50	9.12	11.82	2.70
Mid. Intell.	29	6.28	9.24	2.96
Low Intell.	33	4.34	6.61	2.27
Male	66	6.92	9.53	2.61
Female	46	7.04	9.70	2.66

TABLE 37b

ANALYSIS OF COVARIANCE FOR TABLES 36c AND 36d

Source	df	SS	MS	F
Treatment	1	157.23	157.23	34.31**
Intelligence	2	107.66	53.83	11.75**
Sex	1	.87	.87	.19
Treat. x Intell.	2	4.16	2.08	.45
Treat. x Sex	1	3.08	3.08	.67
Intell. x Sex	2	1.54	.77	.17
Treat. x Intell. x Sex	2	6.55	3.28	.72
Within	99	453.69	4.58	
Total	110	734.78		

**Significant at the .01 level

TABLE 36e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

Treatment 1												Treatment 2											
Low(11)				Middle(20)				High(28)				Low(22)				Middle(9)				High(22)			
Male(8)		Female(3)		Male(10)		Female(10)		Male(14)		Female(14)		Male(13)		Female(9)		Male(4)		Female(5)		Male(17)		Female(5)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.00	4.75	2.67	4.00	5.10	5.90	5.00	6.00	7.43	9.29	7.57	9.07	3.77	4.23	3.78	4.78	4.25	5.25	5.40	6.40	6.12	7.18	7.20	7.60

TABLE 36f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 36e

	N	Pretest	Posttest	Gain
Treatment 1	59	5.96	7.21	1.25
Treatment 2	53	5.04	5.88	.84
High Intell.	50	7.00	8.34	1.34
Mid. Intell.	29	5.00	5.93	.93
Low Intell.	33	3.73	4.49	.76
Male	66	5.41	6.44	1.03
Female	46	5.67	6.78	1.11

TABLE 37c

ANALYSIS OF COVARIANCE FOR TABLES 36e AND 36f

Source	df	SS	MS	F
Treatment	1	10.24	10.24	2.63
Intelligence	2	58.88	29.44	7.57*
Sex	1	1.05	1.05	.27
Treat. x Intell.	2	8.86	4.43	1.14
Treat. x Sex	1	1.15	1.15	.29
Intell. x Sex	2	1.24	.62	.16
Treat. x Intell. x Sex	2	.19	.09	.02
Within	99	385.22	3.89	
Total	110	466.83		

*Significant at the .05 level

TABLE 36g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

Treatment 1												Treatment 2											
Low(11)				Middle(20)				High(28				Low(22)				Middle(9)				High(22)			
Male(8)		Female(3)		Male(10)		Female(10)		Male(14)		Female(14)		Male(13)		Female(9)		Male(4)		Female(5)		Male(17)		Female(5)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.75	5.63	3.67	4.67	6.60	10.20	7.20	9.20	10.71	13.21	9.86	12.93	3.46	4.15	5.11	4.56	5.25	6.75	7.20	8.00	9.47	12.00	9.40	12.40

TABLE 36h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 36g

	N	Pretest	Posttest	Gain
Treatment 1	59	8.06	10.49	2.43
Treatment 2	53	6.71	8.11	1.40
High Intell.	50	9.92	12.64	2.72
Mid. Intell.	29	6.72	9.00	2.28
Low Intell.	33	4.24	4.67	.43
Male	66	7.29	7.96	.67
Female	46	7.61	9.35	1.74

TABLE 37d

ANALYSIS OF COVARIANCE FOR TABLES 36g AND 36h

Source	df	SS	MS	F
Treatment	1	21.68	21.68	3.09
Intelligence	2	218.89	109.44	15.59**
Sex	1	1.21	1.21	.17
Treat. x Intell.	2	9.48	4.74	.67
Treat. x Sex	1	.04	.04	.01
Intell. x Sex	2	6.83	3.42	.49
Treat. x Intell. x Sex	2	2.62	1.31	.19
Within	99	695.20	7.02	
Total	110	955.95		

**Significant at the .01 level

TABLE 36i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE THREE

Treatment 1												Treatment 2											
Low(11)				Middle(20)				High(28)				Low(22)				Middle(9)				High(22)			
Male(8)		Female(3)		Male(10)		Female(10)		Male(14)		Female(14)		Male(13)		Female(9)		Male(4)		Female(5)		Male(17)		Female(5)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
61.88	61.88	49.00	61.00	66.80	78.60	64.70	76.70	82.64	90.43	83.43	90.36	32.46	53.46	44.33	65.89	53.25	71.75	58.80	77.00	70.12	88.94	82.60	89.40

TABLE 36j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 36i

	N	Pretest	Posttest	Gain
Treatment 1	59	72.58	80.71	7.13
Treatment 2	53	55.34	73.94	18.60
High Intell.	50	78.60	89.80	11.20
Mid. Intell.	29	62.83	76.72	13.89
Low Intell.	33	44.33	59.58	15.25
Male	66	62.83	76.38	13.55
Female	46	66.70	79.13	12.43

TABLE 37e

ANALYSIS OF COVARIANCE FOR TABLES 36i AND 36j

Source	df	SS	MS	F
Treatment	1	403.25	403.25	5.98*
Intelligence	2	1243.80	621.90	9.23**
Sex	1	16.00	16.00	.24
Treat. x Intell.	2	82.58	41.29	.61
Treat. x Sex	1	17.64	17.64	.26
Intell. x Sex	2	352.54	176.27	2.62
Treat. x Intell. x Sex	2	80.43	40.22	.60
Within	99	6671.18	67.39	
Total	110	8867.42		

*Significant at the .05 level
**Significant at the .01 level

TABLE 38a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

Treatment 1												Treatment 2											
Low(18)				Middle(21)				High(21)				Low(20)				Middle(23)				High(15)			
Male(11)		Female(7)		Male(13)		Female(8)		Male(10)		Female(11)		Male(10)		Female(10)		Male(13)		Female(10)		Male(5)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
13.09	14.18	13.43	11.86	14.31	18.92	15.13	18.38	15.40	20.00	16.64	21.91	14.20	13.20	15.70	16.60	17.54	17.00	17.80	17.90	15.40	19.20	17.50	20.50

TABLE 38b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 38a

	N	Pretest	Posttest	Gain
Treatment 1	60	14.87	17.88	3.01
Treatment 2	58	16.50	17.22	.72
High Intell.	36	16.36	20.61	4.25
Mid. Intell.	44	16.21	18.02	1.81
Low Intell.	38	14.13	14.16	.03
Male	62	15.02	16.95	1.93
Female	56	16.22	18.23	2.01

TABLE 39a

ANALYSIS OF COVARIANCE FOR TABLES 38a AND 38b

Source	df	SS	MS	F
Treatment	1	46.89	46.89	2.38
Intelligence	2	483.83	241.92	12.30**
Sex	1	11.86	11.86	.60
Treat. x Intell.	2	64.96	32.48	1.65
Treat. x Sex	1	29.63	29.63	1.51
Intell. x Sex	2	4.62	2.31	.12
Treat. x Intell. x Sex	2	41.58	20.79	1.06
Within	105	2064.93	19.67	
Total	116	2748.30		

**Significant at the .01 level

TABLE 38c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

Treatment 1												Treatment 2											
Low(18)				Middle(21)				High(21)				Low(20)				Middle(23)				High(15)			
Male(11)		Female(7)		Male(13)		Female(8)		Male(10)		Female(11)		Male(10)		Female(10)		Male(13)		Female(10)		Male(5)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.45	6.09	4.43	4.71	6.08	7.62	5.00	8.25	6.50	9.70	5.82	8.73	5.10	5.80	6.30	7.30	6.31	6.15	5.40	6.90	5.60	7.00	6.60	8.50

TABLE 38d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 38c

	N	Pretest	Posttest	Gain
Treatment 1	60	5.82	7.64	1.82
Treatment 2	58	5.92	6.89	.97
High Intell.	36	6.70	8.70	2.00
Mid. Intell.	44	5.80	7.14	1.34
Low Intell.	38	5.39	6.08	.69
Male	62	5.58	7.03	1.45
Female	56	5.13	7.54	2.41

TABLE 39b

ANALYSIS OF COVARIANCE FOR TABLES 38c AND 38d

Source	df	SS	Ms	F
Treatment	1	12.86	12.86	2.34
Intelligence	2	102.04	51.02	9.28**
Sex	1	8.92	8.92	1.62
Treat. x Intell.	2	32.65	16.32	2.97
Treat. x Sex	1	11.94	11.94	2.17
Intell. x Sex	2	4.49	2.25	.41
Treat. x Intell. x Sex	2	7.66	3.83	.70
Within	105	576.96	5.49	
Total	116	757.52		

**Significant at the .01 level

TABLE 38e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

Treatment 1												Treatment 2											
Low(18)				Middle(21)				High(21)				Low(20)				Middle(23)				High(15)			
Male(11)		Female(7)		Male(13)		Female(8)		Male(10)		Female(11)		Male(10)		Female(10)		Male(13)		Female(10)		Male(5)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
3.45	3.45	3.71	3.00	3.54	5.00	4.50	4.63	4.40	5.50	5.27	6.18	4.20	3.10	4.30	4.50	4.54	5.23	6.40	4.80	5.20	5.80	5.40	5.50

TABLE 38f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 38e

	N	Pretest	Posttest	Gain
Treatment 1	60	4.13	4.74	.61
Treatment 2	58	4.96	4.76	-.20
High Intell.	36	5.05	5.75	.70
Mid. Intell.	44	4.66	4.96	.30
Low Intell.	38	3.92	3.55	-.37
Male	62	4.11	4.75	.64
Female	56	5.02	4.89	-.13

TABLE 39c

ANALYSIS OF COVARIANCE FOR TABLES 38e AND 38f

Source	df	SS	MS	F
Treatment	1	.44	.44	.12
Intelligence	2	60.66	30.33	8.26**
Sex	1	.01	.01	.00
Treat. x Intell.	2	2.37	1.18	.32
Treat. x Sex	1	.33	.33	.09
Intell. x Sex	2	10.26	5.13	1.40
Treat. x Intell. x Sex	2	9.37	4.68	1.28
Within	105	385.38	3.67	
Total	116	468.82		

**Significant at the .01 level

TABLE 38g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

Treatment 1												Treatment 2											
Low(18)				Middle(21)				High(21)				Low(20)				Middle(23)				High(15)			
Male(11)		Female(7)		Male(13)		Female(8)		Male(10)		Female(11)		Male(10)		Female(10)		Male(13)		Female(10)		Male(5)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.18	4.55	5.29	4.14	4.69	6.31	5.63	5.50	4.50	4.80	5.55	7.00	4.90	4.30	5.10	4.80	6.85	5.62	6.00	6.20	4.60	6.40	5.50	6.50

TABLE 38h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 38g

	N	Pretest	Posttest	Gain
Treatment 1	60	4.92	5.50	.58
Treatment 2	58	5.62	5.57	-.05
High Intell.	36	5.11	6.17	1.06
Mid. Intell.	44	5.80	5.93	.13
Low Intell.	38	4.82	4.47	-.35
Male	62	5.05	5.29	.24
Female	56	5.52	5.80	.28

TABLE 39d

ANALYSIS OF COVARIANCE FOR TABLES 38g AND 38h

Source	df	SS	MS	F
Treatment	1	.16	.16	.03
Intelligence	2	49.74	24.87	4.47**
Sex	1	4.17	4.17	.75
Treat. x Intell.	2	2.98	1.49	.27
Treat. x Sex	1	2.48	2.48	.45
Intell. x Sex	2	9.30	4.65	.84
Treat. x Intell. x Sex	2	19.43	9.72	1.75
Within	105	584.39	5.57	
Total	116	672.65		

**Significant at the .01 level

TABLE 38i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FOUR

Treatment 1												Treatment 2											
Low(18)				Middle(21)				High(21)				Low(20)				Middle(23)				High(15)			
Male(11)		Female(7)		Male(13)		Female(8)		Male(10)		Female(11)		Male(10)		Female(10)		Male(13)		Female(10)		Male(5)		Female(10)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
34.00	45.64	29.71	40.71	42.31	60.00	42.00	57.00	54.70	72.20	60.82	76.91	43.10	56.80	50.80	58.70	60.00	72.85	65.30	75.70	55.00	77.20	64.60	79.40

TABLE 38j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 38i

	N	Pretest	Posttest	Gain
Treatment 1	60	44.73	59.85	15.12
Treatment 2	58	56.78	69.64	12.86
High Intell.	36	59.36	76.33	16.97
Mid. Intell.	44	52.71	66.82	14.11
Low Intell.	38	40.03	51.11	11.08
Male	62	47.69	62.99	15.30
Female	56	53.93	66.52	12.59

TABLE 39e

ANALYSIS OF COVARIANCE FOR TABLES 38i AND 38j

Source	df	SS	MS	F
Treatment	1	9.33	9.33	.08
Intelligence	2	1337.96	668.98	6.04**
Sex	1	77.18	77.18	.70
Treat. x Intell.	2	80.07	40.03	.36
Treat. x Sex	1	23.95	23.95	.22
Intell. x Sex	2	2.30	1.15	.01
Treat. x Intell. x Sex	2	53.31	26.66	.24
Within	105	11633.79	110.80	
Total	116	13217.89		

**Significant at the .01 level

TABLE 40a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

Treatment 1												Treatment 2											
Low(7)				Middle(32)				High(21)				Low(3)				Middle(17)				High(36)			
Male(4)		Female(3)		Male(15)		Female(17)		Male(11)		Female(10)		Male(2)		Female(1)		Male(12)		Female(5)		Male(17)		Female(19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
15.25	18.25	18.33	17.00	16.40	21.67	19.53	27.71	24.64	33.27	24.40	31.90	16.00	18.50	12.00	18.00	21.42	23.67	22.00	21.60	23.35	26.53	26.26	31.68

TABLE 40b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 40a

	N	Pretest	Posttest	Gain
Treatment 1	60	20.33	26.75	6.42
Treatment 2	56	23.34	26.79	3.45
High Intell.	57	24.75	30.49	5.74
Mid. Intell.	49	19.29	24.25	4.96
Low Intell.	10	16.00	17.90	1.90
Male	61	20.72	25.18	4.46
Female	55	22.76	28.53	5.77

TABLE 41a

ANALYSIS OF COVARIANCE FOR TABLES 40a AND 40b

Source	df	SS	MS	F
Treatment	1	311.01	311.01	10.86**
Intelligence	2	246.96	123.48	4.31**
Sex	1	87.42	87.42	3.05
Treat. x Intell.	2	65.56	32.78	1.15
Treat. x Sex	1	.14	.14	.01
Intell. x Sex	2	35.95	17.98	.63
Treat. x Intell. x Sex	2	164.75	82.38	2.88
Within	103	2948.64	28.63	
Total	114	3860.43		

**Significant at the .01 level

TABLE 40c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

Treatment 1												Treatment 2											
Low(7)				Middle(32)				High(21)				Low(3)				Middle(17)				High(36)			
Male(4)		Female(3)		Male(15)		Female(17)		Male(11)		Female(10)		Male(2)		Female(1)		Male(12)		Female(5)		Male(17)		Female(19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.50	9.00	7.00	7.33	7.13	9.53	6.71	11.59	9.09	14.55	9.40	14.30	6.50	6.00	3.00	7.00	7.58	8.08	7.20	7.60	8.76	8.41	9.68	11.63

TABLE 40d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 40c

	N	Pretest	Posttest	Gain
Treatment 1	60	7.70	11.69	3.99
Treatment 2	56	8.32	9.25	.93
High Intell.	57	9.24	11.70	2.46
Mid. Intell.	49	7.10	9.69	2.59
Low Intell.	10	5.90	7.70	1.80
Male	61	7.90	9.69	1.79
Female	55	8.22	11.42	3.20

TABLE 41b

ANALYSIS OF COVARIANCE FOR TABLES 40c AND 40d

Source	df	SS	MS	F
Treatment	1	310.21	310.21	39.77**
Intelligence	2	39.65	19.82	2.54
Sex	1	70.97	70.97	9.10**
Treat. x Intell.	2	29.39	14.69	1.88
Treat. x Sex	1	3.99	3.99	.51
Intell. x Sex	2	14.74	7.37	.95
Treat. x Intell. x Sex	2	54.79	27.40	3.51
Within	103	803.30	7.80	
Total	114	1327.04		

**Significant at the .01 level

TABLE 40e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

Treatment 1												Treatment 2											
Low(7)				Middle(32)				High(21)				Low(3)				Middle(17)				High(36)			
Male(4)		Female(3)		Male(15)		Female(17)		Male(11)		Female(10)		Male(2)		Female(1)		Male(12)		Female(5)		Male(17)		Female(19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.50	4.25	5.67	4.67	5.47	5.80	6.47	7.71	8.45	9.18	7.60	9.00	5.00	7.00	2.00	4.00	7.42	7.92	7.00	7.00	8.82	9.18	7.89	9.32

TABLE 40f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 40e

	N	Pretest	Posttest	Gain
Treatment 1	60	6.73	7.33	.60
Treatment 2	56	7.43	8.59	1.16
High Intell.	57	8.22	9.20	.98
Mid. Intell.	49	6.45	7.10	.65
Low Intell.	10	4.70	4.90	.20
Male	61	7.24	7.71	.47
Female	55	7.09	8.20	1.11

TABLE 41c

ANALYSIS OF COVARIANCE FOR TABLES 40e AND 40f

Source	df	SS	MS	F
Treatment	1	2.77	2.77	.52
Intelligence	2	70.91	35.45	6.65**
Sex	1	9.14	9.14	1.71
Treat. x Intell.	2	6.07	3.03	.57
Treat. x Sex	1	4.91	4.91	.92
Intell. x Sex	2	4.28	2.14	.40
Treat. x Intell. x Sex	2	9.50	4.75	.89
Within	103	548.92	5.33	
Total	114	656.50		

**Significant at the .01 level

TABLE 40g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

Treatment 1												Treatment 2											
Low(7)				Middle(32)				High(21)				Low(3)				Middle(17)				High(36)			
Male(4)		Female(3)		Male(15)		Female(17)		Male(11)		Female(10)		Male(2)		Female(1)		Male(12)		Female(5)		Male(17)		Female(19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.25	5.00	5.67	5.00	3.80	6.33	6.35	8.41	7.09	9.55	7.40	8.60	4.50	5.50	7.00	7.00	6.42	7.67	7.80	7.00	7.53	8.94	8.68	10.74

TABLE 40h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 40g

	N	Pretest	Posttest	Gain
Treatment 1	60	5.90	7.73	1.83
Treatment 2	56	7.59	8.95	1.36
High Intell.	57	7.81	9.60	1.79
Mid. Intell.	49	5.73	7.45	1.73
Low Intell.	10	5.40	5.30	-.10
Male	61	6.07	7.79	1.72
Female	55	7.45	8.91	1.46

TABLE 41d

ANALYSIS OF COVARIANCE FOR TABLES 40g AND 40h

Source	df	SS	MS	F
Treatment	1	.51	.51	.07
Intelligence	2	71.05	35.53	5.01**
Sex	1	2.94	2.94	.41
Treat. x Intell.	2	10.63	5.31	.75
Treat. x Sex	1	1.65	1.65	.23
Intell. x Sex	2	.73	.36	.05
Treat. x Intell. x Sex	2	26.26	13.13	1.85
Within	103	730.73	7.09	
Total	114	844.50		

**Significant at the .01 level

TABLE 40i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE FIVE

Treatment 1												Treatment 2											
Low(7)				Middle(32)				High(21)				Low(3)				Middle(17)				High(36)			
Male(4)		Female(3)		Male(15)		Female(17)		Male(11)		Female(10)		Male(2)		Female(1)		Male(12)		Female(5)		Male(17)		Female(19)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
66.25	73.00	71.00	72.00	62.00	76.87	81.65	91.24	88.64	100.00	88.60	98.50	56.00	75.50	23.00	23.00	80.92	88.08	83.60	91.00	93.88	98.29	96.16	103.05

TABLE 40j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 40i

	N	Pretest	Posttest	Gain
Treatment 1	60	77.62	88.28	10.66
Treatment 2	56	88.34	94.91	6.57
High Intell.	57	92.70	100.24	7.54
Mid. Intell.	49	75.66	86.04	10.38
Low Intell.	10	61.30	68.20	6.90
Male	61	79.49	88.92	9.43
Female	55	86.46	94.33	7.87

TABLE 41e

ANALYSIS OF COVARIANCE FOR TABLES 40i AND 40j

Source	df	SS	MS	F
Treatment	1	56.19	56.19	.59
Intelligence	2	1233.99	617.00	6.51**
Sex	1	55.29	55.29	.58
Treat. x Intell.	2	23.92	11.96	.13
Treat. x Sex	1	2.08	2.08	.02
Intell. x Sex	2	425.60	212.80	2.25
Treat. x Intell. x Sex	2	499.08	249.54	2.63
Within	103	9757.81	94.74	
Total	114	12053.96		

**Significant at the .01 level

TABLE 42a

UNADJUSTED MEAN SCORES ON THE CRITICAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

Treatment 1												Treatment 2											
Low(10)				Middle(28)				High(17)				Low(11)				Middle(19)				High(13)			
Male(5)		Female(5)		Male(17)		Female(11)		Male(5)		Female(12)		Male(6)		Female(5)		Male(6)		Female(13)		Male(5)		Female(8)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
16.60	20.00	17.80	18.40	19.71	27.24	23.55	29.64	29.20	35.00	27.33	35.08	18.17	20.67	19.20	16.40	22.67	28.17	24.23	29.00	26.20	30.80	32.00	36.75

TABLE 42b

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 42a

	N	Pretest	Posttest	Gain
Treatment 1	55	22.55	28.67	6.12
Treatment 2	43	24.23	27.91	3.68
High Intell.	30	28.70	34.80	6.10
Mid. Intell.	47	22.24	28.41	6.17
Low Intell.	21	17.95	18.95	1.00
Male	44	21.37	26.93	5.56
Female	54	24.87	29.48	4.61

TABLE 43a

ANALYSIS OF COVARIANCE FOR TABLES 42a AND 42b

Source	df	SS	MS	F
Treatment	1	50.03	50.03	1.50
Intelligence	2	685.74	342.87	10.31**
Sex	1	.02	.02	.00
Treat. x Intell.	2	2.00	1.00	.03
Treat. x Sex	1	1.26	1.26	.04
Intell. x Sex	2	87.26	43.63	1.31
Treat. x Intell. x Sex	2	7.48	3.74	.11
Within	85	2826.35	33.25	
Total	96	3660.14		

**Significant at the .01 level

TABLE 42c

UNADJUSTED MEAN SCORES ON THE LOGIC SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

Treatment 1												Treatment 2											
Low(10)				Middle(28)				High(17)				Low(11)				Middle(19)				High(13)			
Male(5)		Female(5)		Male(17)		Female(11)		Male(5)		Female(12)		Male(6)		Female(5)		Male(6)		Female(13)		Male(5)		Female(8)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
7.20	9.40	6.40	7.20	8.41	11.59	8.82	11.82	11.60	14.60	9.67	14.58	7.17	8.83	6.80	6.40	8.33	10.83	8.85	10.23	12.00	11.40	12.38	14.00

TABLE 42d

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 42c

	N	Pretest	Posttest	Gain
Treatment 1	55	8.70	11.99	3.29
Treatment 2	43	9.32	10.52	1.20
High Intell.	30	11.10	13.90	2.80
Mid. Intell.	47	8.62	11.17	2.55
Low Intell.	21	6.91	8.00	1.09
Male	44	8.86	11.18	2.32
Female	54	9.13	11.44	2.31

TABLE 43b

ANALYSIS OF COVARIANCE FOR TABLES 42c AND 42d

Source	df	SS	MS	F
Treatment	1	50.52	50.52	4.60**
Intelligence	2	180.37	90.18	8.21**
Sex	1	.62	.62	.06
Treat. x Intell.	2	7.22	3.61	.33
Treat. x Sex	1	.09	.09	.01
Intell. x Sex	2	41.18	20.59	1.88
Treat. x Intell. x Sex	2	7.01	3.50	.32
Within	85	933.44	10.98	
Total	96	1220.45		

**Significant at the .01 level

TABLE 42e

UNADJUSTED MEAN SCORES ON THE GENERAL SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

Treatment 1												Treatment 2											
Low(10)				Middle(28)				High(17)				Low(11)				Middle(19)				High(13)			
Male(5)		Female(5)		Male(17)		Female(11)		Male(5)		Female(12)		Male(6)		Female(5)		Male(6)		Female(13)		Male(5)		Female(8)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
4.40	5.20	5.80	5.40	6.18	8.71	7.55	8.45	9.40	9.60	8.83	10.33	4.50	6.33	6.00	5.00	8.50	8.67	7.85	8.62	7.40	9.20	9.13	10.88

TABLE 42f

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 42e

	N	Pretest	Posttest	Gain
Treatment 1	55	7.10	8.49	1.39
Treatment 2	43	7.44	8.38	.94
High Intell.	30	8.77	10.17	1.40
Mid. Intell.	47	7.26	8.62	1.36
Low Intell.	21	5.14	5.52	.38
Male	44	6.57	8.14	1.57
Female	54	7.84	8.67	.83

TABLE 43c

ANALYSIS OF COVARIANCE FOR TABLES 42e AND 42f

Source	df	SS	MS	F
Treatment	1	.51	.51	.10
Intelligence	2	46.64	23.32	4.57**
Sex	1	2.81	2.81	.55
Treat. x Intell.	2	8.00	4.00	.78
Treat. x Sex	1	.23	.23	.05
Intell. x Sex	2	17.98	8.99	1.76
Treat. x Intell. x Sex	2	10.30	5.15	1.01
Within	85	434.00	5.11	
Total	96	520.47		

**Significant at the .01 level

TABLE 42g

UNADJUSTED MEAN SCORES ON THE LITERATURE SUB-TEST BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

Treatment 1												Treatment 2											
Low(10)				Middle(28)				High(17)				Low(11)				Middle(19)				High(13)			
Male(5)		Female(5)		Male(17)		Female(11)		Male(5)		Female(12)		Male(6)		Female(5)		Male(6)		Female(13)		Male(5)		Female(8)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.00	5.40	5.60	5.80	5.12	6.94	8.09	8.82	8.20	10.80	8.83	10.17	6.50	5.50	6.40	5.00	5.83	8.67	7.54	10.15	6.80	10.20	10.38	11.75

TABLE 42h

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 42g

	N	Pretest	Posttest	Gain
Treatment 1	55	6.75	8.19	1.44
Treatment 2	43	7.47	9.01	1.54
High Intell.	30	8.80	10.70	1.90
Mid. Intell.	47	6.58	8.48	1.90
Low Intell.	21	5.90	5.43	-.47
Male	44	5.93	7.61	1.68
Female	54	8.07	9.24	1.17

TABLE 43d

ANALYSIS OF COVARIANCE FOR TABLES 42g AND 42h

Source	df	SS	MS	F
Treatment	1	15.34	15.34	2.25
Intelligence	2	180.87	90.43	13.26**
Sex	1	11.74	11.74	1.72
Treat. x Intell.	2	18.05	9.03	1.32
Treat. x Sex	1	.60	.60	.09
Intell. x Sex	2	8.83	4.41	.65
Treat. x Intell. x Sex	2	1.89	.94	.14
Within	85	579.69	6.82	
Total	96	817.01		

**Significant at the .01 level

TABLE 42i

UNADJUSTED MEAN SCORES ON THE GENERAL READING TEST TOTAL BY TREATMENT, SEX, AND INTELLIGENCE FOR GRADE SIX

Treatment 1												Treatment 2											
Low(10)				Middle(28)				High(17)				Low(11)				Middle(19)				High(13)			
Male(5)		Female(5)		Male(17)		Female(11)		Male(5)		Female(12)		Male(6)		Female(5)		Male(6)		Female(13)		Male(5)		Female(8)	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
62.20	70.20	63.80	75.20	82.71	94.47	90.00	98.55	97.60	105.40	102.17	108.33	55.00	71.83	65.00	82.40	87.67	99.83	89.54	96.46	99.60	101.80	107.25	109.75

TABLE 42j

UNADJUSTED MAIN EFFECT MEANS FOR TABLE 42i

	N	Pretest	Posttest	Gain
Treatment 1	55	86.18	95.35	9.17
Treatment 2	43	86.19	94.98	8.79
High Intell.	30	102.33	107.13	4.80
Mid. Intell.	47	86.94	96.66	9.72
Low Intell.	21	61.19	74.76	13.57
Male	44	80.88	91.43	10.55
Female	54	90.41	98.22	7.81

TABLE 43e

ANALYSIS OF COVARIANCE FOR TABLES 42i AND 42j

Source	df	SS	MS	F
Treatment	1	.17	.17	.00
Intelligence	2	337.80	168.90	2.14
Sex	1	16.55	16.55	.21
Treat. x Intell.	2	242.22	121.11	1.54
Treat. x Sex	1	16.88	16.88	.21
Intell. x Sex	2	152.59	76.29	.97
Treat. x Intell. x Sex	2	53.70	26.85	.34
Within	85	6700.12	78.83	
Total	96	7520.03		